VOLUME 31 JULY 1938 NUMBER 7

Southern Medical Journal

Journal of the Southern Medical Association

Copyright, Southern Medical Association, 1938. Published monthly by the Southern Medical Association, Empire Building, Birmingham, Alabama. Annual subscription, $4.00. Entered as Second-Class Matter at the Post Office at Birmingham, Alabama, under Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized December 20, 1921.

Southern Medical Association, Thirty-Second Annual Meeting, Oklahoma City, November 15-18

TABLE OF CONTENTS

The Physiologic Approach to the Correction of Constipation. P. B. Welch and F. H. Kauders, Miami, Florida ... 709
Discussed by C. W. Dowden, Louisville, Ky.

Intestinal Tuberculosis: A Pathologic and Clinical Survey. Charles T. Stone and Loyd W. Sheckles, Jr., Galveston, Texas ... 715
Discussed by Paul H. Ringer, Asheville, N. C.; Frederic M. Hanes, Durham, N. C.; V. C. Tucker, San Antonio, Tex.

The Treatment of Hypoparathyroidism with Dihydrotachysterol. Cyril M. MacBryde, St. Louis, Missouri ... 720
Discussed by Frederic M. Hanes, Durham, N. C.; Samuel S. Riven, Nashville, Tenn.

Operative Treatment of Inguinal Hernia: Report of One Thousand and Forty-Eight Cases. Edward T. West, Lee K. Gibson and Horace B. Cupp, Johnson City, Tennessee ... 726
Discussed by Lucian H. Landry, New Orleans, La.

Management of Pyelitis of Pregnancy. H. K. Turley, Memphis, Tennessee ... 729
Discussed by M. Q. Ewing, Amory, Miss.

An Analytical Study of 310 Consecutive Hysterectomies. Thomas B. Sellers and John T. Sanders, New Orleans, Louisiana, and James W. Welch, Alexandria, Louisiana ... 733

Further Observation on Intensive Radiation of Hyperthyroidism. S. C. Barrow, Shreveport, Louisiana ... 737
Discussed by I. Warner Jenkins, Waco, Tex.; Stakely Hatchette, Lake Charles La.; Ralph E. Myers, Oklahoma City, Okla.

The Rational Treatment of Acne Vulgaris. Garold V. Stryker and Manuel G. Bloom, St. Louis, Missouri ... 741
Discussed by Thomas W. Murrell, Richmond, Va.; D. Truett Gandy, Houston, Tex.; Leo N. Elson, New Orleans, La.

The Management of Compound Fractures. Guy A. Caldwell, New Orleans, Louisiana ... 746

The Persimmon Phytobezoar: A Report of Three Cases. Richard Joseph White, Fort Worth, Texas ... 750
Discussed by Urban Maes, New Orleans, La.; R. A. Woolsey, St. Louis, Mo.; J. Q. Graves, Monroe, La.

Prostatic Calculi. I. G. Duncan, Memphis, Tennessee ... 756
Discussed by H. Fay H. Jones, Little Rock, Ark.

Hemorrhage and Rupture of the Adrenal in the New Born Infant. Sam Phillips, Little Rock, Arkansas ... 759

Vegetative Intimitis of the Pulmonary Artery in a Boy with Congenital Intraventricular Septal Defect, Persistent Conus Arteriosus and Bicuspid Pulmonary Valve: Report of Case. L. C. Posey, Birmingham, Alabama ... 761
Discussed by Harvey S. Thatcher, Little Rock, Ark.; E. H. Lawson, New Orleans, La.

Traumatic Chylothorax. R. T. Shackelford and A. M. Fisher, Baltimore, Maryland ... 766
Discussed by Rawley M. Penick, Jr., New Orleans, La.; Frank K. Boland, Atlanta, Ga.

Continued on Next Page

TABLE OF CONTENTS—Continued

Gas Gangrene Infections in Industrial Practice With Especial Reference to Infections Following Compound Fractures and Other Accidents. Clinton H. Ramsey, Laurel, Mississippi ... 775

Discussed by O. B. Zeinert, St. Louis, Mo.; E. Dunbar Newell, Chattanooga, Tenn.; James W. Davis, Statesville, N. C.

Recent Advances in Block Anesthesia. Charles Brown Odom, New Orleans, Louisiana ... 778

Some Modifications of the Cardio-respiratory Test of Frost. O. W. Bethea, New Orleans, Louisiana ... 783

Functions and Uses of Psychopathic Hospitals. Lawrence F. Woolley, Towson, Maryland ... 785

"Death of the Sentence" in Medicine. Wiley D. Forbus, Durham, North Carolina ... 792

SYMPOSIUM ON MALARIA—Part 1

The Occurrence of Anopheles Walkeri Theobald in Georgia. R. Edward Bellamy and Justin Andrews, Atlanta, Georgia ... 797

Historical Developments and Progress in our Knowledge of Malaria Control. W. V. King, Orlando, Florida 797

A. Albimanus Breeding in Relation to Degree of Shade in Breeding Places. Henry P. Carr, Havana, Cuba ... 803

Recent Developments in Methods of Mosquito Control in Antimalaria Campaigns. E. Harold Hinman, Wilson Dam, Alabama ... 805

Further Observations on Airplane Dusting for Anopheles Larvae Control. Calvin C. Kiker, Charles D. Fairer and Paul N. Flanary, Wilson Dam, Alabama ... 808

Different Phases of Permanent Drainage for Malaria Control in Mississippi. Nelson H. Rector, Jackson, Mississippi ... 813

Malaria Mortality in the Southern United States for the Year 1936. Ernest Carroll Faust, New Orleans, Louisiana ... 816

Report of the Subcommittee on Malaria Prevention Activities, 1937. L. L. Williams, Jr., Washington, D. C. ... 818

EDITORIALS ... 820

OKLAHOMA CITY — WHERE WE MEET ... 822

BOOK REVIEWS ... 824

SOUTHERN MEDICAL NEWS ... 825

GOEPP'S

MEDICAL STATE BOARDS

New (7th) Edition

This widely used and highly practical book has been completely rewritten and brought up-to-date. There are new questions, revised questions, improvements in arrangement, and an entirely new and especially valuable section on Medical Jurisprudence.

This book is based on Dr. Goepp's wide experience as a teacher and on his thorough familiarity with State Board Questions. Its hundreds and hundreds of questions were taken from actual state board examinations that have been given throughout the country. But more than that, this book gives the answers—concisely yet completely, in the style approved by examiners. It is Today's "Question and Answer" book.

By R. Max Goepp, M.D., formerly Professor of Clinical Medicine, Graduate School of Medicine, University of Pennsylvania. Octavo of 644 pages. Price $5.50.

Send orders to

New Orleans **J. A. MAJORS COMPANY** Dallas

YOU can carry these handy, economical, MOSBY Synopsis Books in YOUR Bag!

SYNOPSIS OF GENITO-URINARY DISEASES—DODSON
SYNOPSIS OF GYNECOLOGY—CROSSEN 2d EDITION
SYNOPSIS OF DIGESTIVE DISEASES—KANTOR

To improve the time that otherwise would be lost, carry several of the Mosby Synopsis Books constantly in your handbag. You will be amazed how much information you can store away for future use by perusing these books when delayed on cases. Make a selection today from the group of eight now available.

Newest Addition to Synopsis Series

HARDY

Information Boiled Down for Quick Reference

Hirschman—Synopsis of ANO-RECTAL DISEASES. By Louis J. Hirschman. 288 pp., 174 illustrations, 6 color plates. Price $3.50.

Crossen—Synopsis of GYNECOLOGY. By H. S. Crossen and Robert J. Crossen. 2nd Edition. 247 pp., 106 illustrations. Price $3.00.

Kantor—Synopsis of DIGESTIVE DISEASES. By John L. Kantor. 302 pp., 40 illustrations. Price $3.50.

Zahorsky—Synopsis of PEDIATRICS. By John Zahorsky and T. S. Zahorsky. 2nd Edition. 367 pp., 80 illustrations, 9 color plates. Price $4.00.

Herrmann—Synopsis of DISEASES OF THE HEART AND ARTERIES. By George S. Herrmann. 344 pp., 88 illustrations, 3 color plates. Price $4.00.

Bray—Synopsis of CLINICAL LABORATORY METHODS. By W. E. Bray. 324 pp., 32 illustrations, 11 color plates. Price $3.75.

Dodson—Synopsis of GENITO-URINARY DISEASES. By Austin I. Dodson. 2nd Edition. 294 pp., 112 illustrations. Price $3.00.

Synopsis of the DIAGNOSIS of the ACUTE SURGICAL DISEASES of the ABDOMEN

This new book, just off the press, arranges concisely and completely every proved means of diagnosis of the acute surgical diseases of the abdomen. It provides a quick, accurate, and complete means of study and review of the methods of diagnosis of these urgent diseases. While every proved possibility of laboratory aid to diagnosis has been considered and suggested, special effort has been made toward the recognition and diagnostic application of signs and symptoms of disease that may be seen or felt or heard.

By JOHN A. HARDY, B.Sc., M.D., F.A.C.S., El Paso, Texas

345 pages, 92 illustrations. Price $4.50

THE C. V. MOSBY COMPANY—3525 Pine Blvd., St. Louis, Mo.

SMJ—7-38

Gentlemen: Send me the following Synopsis Volumes, charging my account at the rate of $3.00 a month.

.....

.....

Dr. ..... Address .....

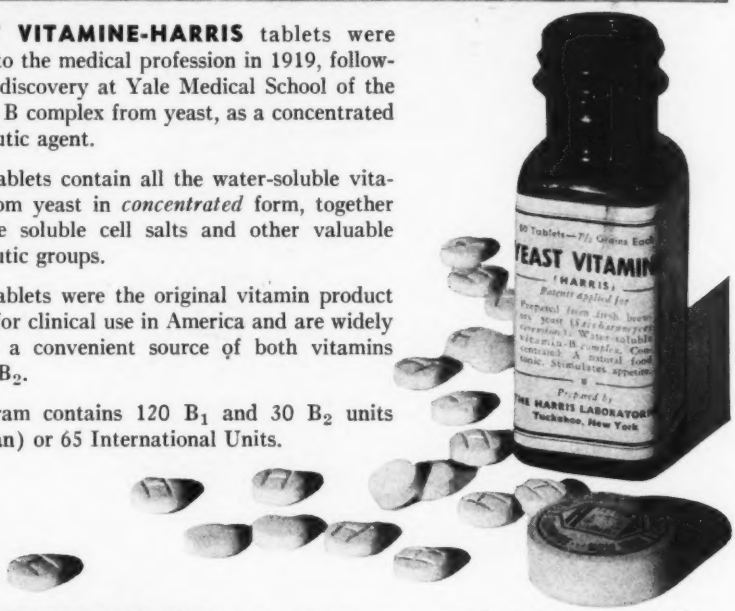
The Original Pioneers Still Lead
in offering
NEWEST VITAMIN THERAPY

YEAST VITAMINE-HARRIS tablets were offered to the medical profession in 1919, following the discovery at Yale Medical School of the vitamin B complex from yeast, as a concentrated therapeutic agent.

These tablets contain all the water-soluble vitamins from yeast in *concentrated* form, together with the soluble cell salts and other valuable therapeutic groups.

These tablets were the original vitamin product offered for clinical use in America and are widely used as a convenient source of both vitamins B_1 and B_2.

Each gram contains 120 B_1 and 30 B_2 units (Sherman) or 65 International Units.



BREWERS' YEAST-HARRIS is the original yeast used in 1925 by Dr. Goldberger—the pioneer in the study of pellagra.

It is still used by the U. S. Public Health Service.

In 1937 it has been shown by Dr. T. D. Spies to contain NICOTINIC ACID which is valuable in curing the lesions of the mucous membrane in pellagra.

Each gram contains 50 B_1 and 30 B_2 units (Sherman) or 66 International Units of B_1.

Brewers' Yeast-Harris is now supplied in powder or in blocks of 7½ grains each. The blocks, with their exact content and convenient form, combined with palatability, are a very pleasant way of taking yeast. The price is the same.

Please specify yeast in *Powder* or *Blocks*. Contains:

Vitamin B_1 (thiamin) anti-neuritic	Yeast cell salts Protein—Nucleic acid Nicotinic Acid	Vitamin B_2 (riboflavin) anti-pellagric

NICOTINIC ACID
In crystalline powder, convenient sizes; or 50 mg. tablets, bottles of 50, for oral administration.

VITAMIN B_1 *(thiamin chloride)*
In powder form, small sizes; or as .10 mg., .50 mg., 1.0 mg. and 5.0 mg. tablets for usual administration by mouth.

THE HARRIS LABORATORIES • • • Tuckahoe, New York

To be published July 15

EXPERIENCE IN THE MANAGEMENT OF FRACTURES AND DISLOCATIONS

(Based on an Analysis of 4390 Cases)

By

THE STAFF OF THE FRACTURE SERVICE MASSACHUSETTS GENERAL HOSPITAL, BOSTON

Under the General Editorship of

PHILIP D. WILSON, M. D.

Surgeon-in-Chief, Hospital for Ruptured and Crippled, New York: Clinical Professor of Orthopaedic Surgery, College of Physicians and Surgeons, Columbia University: formerly Associate Chief, Fracture Service, Massachusetts General Hospital, Boston.

THIS new work differs from other treatises on the same subject in that it is based upon the actual study of cases and the analysis of the results of treatment. Its conclusions are fortified not only by the observation of the patients during their stay in the hospital, but by the actual examination of the same patients a year or more after discharge from the hospital, with critical appraisal of the results in terms of anatomic restoration, functional recovery and working ability or earning power.

The series is so inclusive that any doctor who has a case to treat can almost certainly find a duplicate of his own case in this collection. Hundreds of actual cases with actual tracings, in reduced size, of the x-rays, are included with each section. Approximately 1000 pages; 1500 illustrations. Price $15.00.

For complete information and Outline of Contents, write to the publishers. Or you may order now, and the book will be mailed to you on publication date.

Published By

J. B. LIPPINCOTT COMPANY

East Washington Square, Philadelphia, Pa.

New!

For the treatment of Vitamin B deficiencies—

VITAMIN B PRODUCTS

Lederle

VITAMIN B COMPLEX PARENTERAL *Lederle*

For intramuscular injection. Indicated for the treatment of the various symptoms caused by an acute or prolonged deficiency of one or more of the water-soluble factors which constitute the B complex.

Each cc. contains:
Thiamin (crystalline B_1)—2 mg. (600 International Units)
Riboflavin (B_2)—0.3 mg. (100 Bourquin-Sherman Units)
Nicotinic Acid—10 mgm.
Dermatitis Factor (s) (B_6)—30 "Rat Day" Units
Filtrate Factors—approximately 30 "Chicken Growth" Units
Available in 10 cc. vials.

THIAMIN (CRYSTALLINE VITAMIN B_1) PARENTERAL *Lederle*

For intramuscular injection. Indicated for the intensive treatment of peripheral polyneuritis and other conditions arising from deficient intake or utilization of Vitamin B_1.

Each cc. contains 10 mgm. of Thiamin.
Available in 5 cc. vials.

PELLAGRA SPECIFIC PARENTERAL *Lederle*

For intramuscular injection. Indicated for the treatment of all the symptoms (cutaneous, mucous membrane, gastrointestinal, neurologic and hematologic) occurring in endemic and alcoholic pellagra.

Each cc. contains:
Nicotinic Acid—15 mgm.
Thiamin (crystalline B_1)—2 mgm.
Available in packages of 3–5 cc. vials.

VITAMIN B COMPLEX ORAL *Lederle*

Continues to be available for use in the maintenance of an adequate B intake, for the prevention of Vitamin B deficiencies and for the treatment of the milder manifestations of such deficiencies.

Indicated where there is increased metabolic activity (active growth of children, pregnancy and lactation, febrile conditions, a high caloric intake).

A highly palatable, orange-flavored preparation. Each teaspoonful (4 cc.) now contains:

Thiamin (crystalline B_1)—300 International Units
Riboflavin (B_2)—0.2 mg. (about 65 Bourquin-Sherman Units)
Dermatitis Factor (s) (B_6)—about 10 "Rat Day" Units
Nicotinic Acid or derivatives (pellagra curative) and the Filtrate Factors obtained from 30 grams of liver
Cevitamic Acid (Vitamin C)—20-30 International Units
Available in 4 oz. and 8 oz. bottles.

Send for Literature

LEDERLE LABORATORIES, INC.
30 ROCKEFELLER PLAZA NEW YORK, N. Y.

CLINICAL NOTES

by KNOX

(One of a Series of Correspondence Exchanges with Physicians about Knox Gelatine.)

QUERY: A doctor writes, "In your literature touching on the use of Glycine (amino-acetic acid) in gelatine for the dystrophies, I suggest that you add Postural or Orthostatic Hypotension for two reasons, first, you will be doing a favor to the medical profession by calling to their attention this disease, and secondly, offering a cheaper manner of obtaining glycine. I am enclosing a letter from a Mrs. —— who maintained a systolic blood pressure of 120 when recumbent, but upon standing, it fell so rapidly that she could not get across the room without fainting. All of her symptoms and physical signs were those of Orthostatic Hypotension for which ephedrine hydrochloride had little or no effect, but with the addition of glycocoll, or glycine, 30 grams daily, she has slowly improved and is able to walk for some distance. I would appreciate it if you would send her a menu in which she can get 10 or 15 grams daily of glycine."

ANSWER: Dear Doctor: Thank you indeed for your interesting suggestion. We can add nothing to your noteworthy observation other than to bring it to the attention of the medical profession as widely as possible.

Probably one of the best means of obtaining a concentrated gelatine ration is the following recipe.

"The KNOX FRUIT STIR"

Place the contents of 2 envelopes of Knox Gelatine in an ordinary saucer or cereal dish. Add 8 tablespoonfuls of any desired fresh or canned fruit juice, such as grape juice. Let soak for five minutes and eat with teaspoon.

Total: 4 ounce mixture—100 calories

Why you should insist on Knox Sparkling Gelatine

Because Knox Gelatine is 85% protein in an easily digestible form — because it contains absolutely no sugar or other substances to cause gas or fermentation, Knox Gelatine should not be confused with factory-flavored, sugar-laden dessert powders. Knox is 100% pure U.S.P. gelatine. Knox Gelatine has been successfully used in the dietary of convalescents, anorexic, tubercular, diabetic, colitic, and aged patients.

Sample and useful Dietary Booklets on request. Write Dept. 408

KNOX SPARKLING GELATINE

IS PURE GELATINE—NO SUGAR

KNOX GELATINE LABORATORIES Johnstown, N. Y.

HELP FOR HOT-WEATHER BABIES

HOT WEATHER, as you know, brings special hazards to the bottle-fed infant.

Perhaps the baby travels—is taken where the milk supply is uncertain, refrigeration faulty or lacking. Certainly summer threatens him with lowered fat tolerance and greater probability of gastro-intestinal upsets.

May we, then, remind you of two valuable helps for the hot-weather baby's formula:

1. **For the normal baby—**
Klim Powdered Whole Milk, an ever-safe source of fresh, pure, whole milk that requires no refrigeration.

2. **For the special case of fat intolerance —Dryco,** a powdered milk food requiring no refrigeration and offering reduced fat without corresponding reduction in protein.

We shall gladly supply professional inquirers with helpful feeding data on these two important Borden milk products—Klim and Dryco. Simply write The Borden Company, Prescription Products Division, 350 Madison Avenue, New York City.

Borden's

KLIM AND DRYCO

FOR GREATER CONVENIENCE . . . AMMONIUM MANDELATE IN Tablet FORM

PHYSICIANS who employ mandelic acid therapy will appreciate the advantages of Ammonium Mandelate Squibb. It is the first product of its kind to be supplied in compressed tablet form and is more agreeable and convenient to administer than liquid preparations.

Ammonium Mandelate Squibb is a very effective urinary antiseptic. It is intended for the treatment of acute and chronic cystitis, pyelitis (pyelonephritis), and other infections of the genito-urinary tract. It seems to be most effective in combating the colon bacillus, to which the majority of upper urinary tract infections are due.

Ammonium Mandelate provides several advantages over the ketogenic diet. It can be used in conditions where the diet is contraindicated, such as gout, gastric or duodenal ulcer, diabetes, arteriosclerosis, and biliary tract disturbances. It is less expensive and simpler to use—seldom produces nausea and does not require hospitalization.

Ammonium Mandelate Squibb (Mandamon*) is available in 7½-gr. tablets—bottles of 200 and 1000, and in 3¾-gr. tablets—bottles of 100 and 500.

ALSO AVAILABLE

Serenium*—An antiseptic dye of high purity and uniformity—bacteriostatic in action. Useful in pyelitis (pyelonephritis), cystitis, prostatitis, and gonorrhea. Synergistic with the usual acidifying drugs. May also be used after a course of treatment with Ammonium Mandelate Squibb. Serenium is supplied in bottles of 25, 50, and 500 chocolate-coated tablets of 0.1 gram each.

Nitrazine*—A sensitive indicator—quick and accurate. With it one can determine whether the urine has an acid, alkaline, or neutral reaction and to approximately what degree. A few drops of the urine are applied to a Nitrazine strip which is then compared with a color chart. Nitrazine is available (with color chart) in paper strips, 100 to a vial, 10 vials to a box, and in 0.1 per cent solution in dilute alcohol in 4-oz. and 16-oz. bottles.

For literature write Professional Service Department, 745 Fifth Avenue, New York

*A Squibb Trade-mark.

E·R·SQUIBB & SONS, NEW YORK
MANUFACTURING CHEMISTS TO THE MEDICAL PROFESSION SINCE 1858

ESTIMATED HYPOTHETICAL SALT ANALYSIS

(Grams per 100 c.c.)	Cow's Milk	Breast Milk	Similac
Calcium combined with Protein	.054 gm.	.024 gm.	.030 gm.
Mono-Magnesium Phosphates	.103 gm.	.027 gm.	.027 gm.
Di-Calcium Phosphates	.175 gm.	.000 gm.	.000 gm.
Di-Potassium Phosphates	.230 gm.	.000 gm.	.000 gm.
Potassium Citrates	.052 gm.	.103 gm.	.103 gm.
Sodium Citrates	.222 gm.	.055 gm.	.055 gm.
Calcium Citrates	.119 gm.	.059 gm.	.059 gm.
Iron	Trace	Trace	Trace
Sulphur with Protein	.022 gm.	.001 gm.	.001 gm.
Phosphorus with Protein	.022 gm.	.001 gm.	.001 gm.

C. W. Martin, M. D., New York State Journal of Medicine, September 1, 1932

Consider the SALTS

Laboratory methods of modifying cow's milk, as used in the preparation of Similac, make it possible to rearrange the salts so as to closely approximate the salt balance of breast milk. Similac has a salt balance that cannot be obtained in the usual milk dilutions or modifications as made in the home.

MADE FROM fresh skim milk (casein modified) with added lactose milk fat and vegetable and cod-liver oils.

ACCEPTED AMERICAN MEDICAL ASSN. Council on Foods and Nutrition

A food for infants deprived of breast milk

SIMILAC

M & R DIETETIC LABORATORIES, INCORPORATED, COLUMBUS, OHIO

Summer diarrheas and dysenteries suggest the use of the new

APPELLA
APPLE POWDER
(STEARNS)

Interest in the apple as a therapeutic agent has been greatly stimulated in recent years by the use of scraped raw apple in the treatment of infant diarrheas, dysenteries and other intestinal disorders.

Now, with the development of the improved, highly concentrated, dehydrated Apple *Powder*, even greater attention is being focussed on this valuable form of treatment because of these advantages:

Small bulk
High and uniform potency
Ease of administration
(particularly to children)
No curd formation with milk
Increased content of pectin and uronic acid
All the year 'round availability

In a recent article* the author states: "We are convinced that the greatest value that is to be derived from the use of apple powder in the feeding of children will be in the prophylactic use of the material during the hot season, and in incorporating it routinely in the dietaries of individuals suffering an elevation of body temperature. Its therapeutic value is indicated by the fact that out of 1,021 cases of severe diarrhea unresponsive to other types of treatment, 1,005 recovered."

Write for descriptive literature, giving clinical findings, suggestions on dosage, etc.

HOW SUPPLIED

Appella Apple Powder (Stearns) is supplied in 7-oz. cans for prescription use and in 1 lb. 4-oz. cans for hospital use.

Available through your Prescription Pharmacy.

*Manville, Ira A.: Use of Apple Powder in the Prevention and Cure of Summer Diarrheas, Arch. Pediat. 55:76 (Feb.) 1938.

FREDERICK STEARNS & COMPANY

Detroit • New York • Kansas City • San Francisco • Windsor, Canada • Sydney, Australia

Bring Comfort to the Diarrhea Patient

KAOMAGMA restores bowel confidence and brings comfort to the diarrhea patient by consolidating the stool.

KAOMAGMA is finely divided medicinal kaolin dispersed in a colloidal gel of Aluminum Hydroxide. Kaolin so peptized with alumina gel has the advantage of maximum adsorbent power.

KAOMAGMA promptly checks diarrheas—consolidates fluid stools—eliminates products of putrefaction—prevents dehydration and restores tone to the bowel.

Three Types—KAOMAGMA-PLAIN
KAOMAGMA WITH MINERAL OIL
KAOMAGMA-RECTAL (For rectal administration as a retention enema in colitis).

ALL PHARMACIES SUPPLY IN 12 OUNCE BOTTLES

•

JOHN WYETH & BROTHER, Incorporated
PHILADELPHIA PA.
WALKERVILLE, ONT. **LONDON, ENG.**

NEW PRODUCTS *recently introduced by* SHARP & DOHME

'Caprokol' Jelly—An antiseptic jelly for vaginal application. For the treatment of trichomoniasis and non-specific leukorrhea. An effective germicidal lubricating jelly.

Lirimin Capsules—A new liver-iron-vitamin combination for the treatment of secondary anemias. Contains concentrated liver extract, iron, ascorbic acid (Vitamin C) and Vitamins B_1 and B_2 (G).

Concentrated Liver Extract Capsules—A highly concentrated liver extract for the treatment of pernicious anemia. Only six to nine capsules per day are required for maintenance and treatment.

Elixir B-G-Phos—Contains natural Vitamin B Complex and Glycerophosphates in an exceptionally palatable base. An efficient tonic. Improves the appetite. Stimulates digestive functions.

Esdavite Capsules—A high-potency vitamin combination in a small, round capsule: 10,000 units of A; 120 units of B_1; 10 units of B_2 (G); 1,000 units of D. (Esdavite with Vitamin C: Same formula plus 200 units of C.)

Digitos Tablets—Tablets of digitalis leaves, $1\frac{1}{2}$ grains, slotted to facilitate equal division into smaller doses. Each tablet represents activity of 15 minims Tincture Digitalis U.S.P. XI (approx. one cat unit).

Vitamin B_1, Soluble Tablets—Designed especially for infants and children. A tablet triturate containing 50 units Vitamin B_1 Crystalline. Tasteless and readily soluble in water, milk or fruit juices.

Vitamin D, Soluble Tablets—Also designed especially for administration to infants and children. Tasteless and readily soluble in water, milk or fruit juices. Contains 500 units Vitamin D.

Vitamin B_1, Ampoule-Vial—Sterile solution of Vitamin B_1 Crystalline, 5 cc., each cc. containing 6000 units. Particularly adapted for the parenteral administration of large doses of Vitamin B_1.

Propadrine Hydrochloride—Similar in action to ephedrine. Effectively controls the symptoms of hay fever and asthma with minimum toxic effect. Available in capsules, solution and nasal jelly.

Padrol—Solution of Propadrine in an oil base for topical application in the decongestion of inflamed and engorged nasal mucous membranes.

Thermotabs—Sodium chloride and dextrose tablets, to minimize fatigue and to prevent heat prostration due to excessive perspiration.

DETAILED LITERATURE ON THESE PRODUCTS SENT ON REQUEST

"For the Conservation of Life"

PHARMACEUTICALS
MULFORD BIOLOGICALS
SHARP & DOHME
PHILADELPHIA
BALTIMORE

Diarrhea in Infancy

Take It In Time

Just a day or two of light nourishment prepared from Mellin's Food as suggested below will usually avert an intestinal disturbance that might develop into a serious diarrhea if not taken in hand at the first appearance of loose stools.

Mellin's Food*. . 4 level tablespoonfuls

Water (boiled, then cooled) . . . 16 ounces

Give one to three ounces every hour or two until the stools lessen in number and improve in character.

The mixture may then be strengthened by the gradual substitution of boiled skimmed milk for water until the quantity of skimmed milk is equal to the normal quantity of milk used in the baby's formula. Finally the fat of the milk may be gradually replaced by skimming less and less cream from the milk.

Samples sent to physicians upon request.

Directions for using Mellin's Food are left entirely to the physician.

Mellin's Food Company, Boston, Mass.

**MELLIN'S FOOD: Produced by an infusion of Wheat Flour, Wheat Bran and Malted Barley admixed with Potassium Bicarbonate — consisting essentially of Maltose, Dextrins, Proteins and Mineral Salts.*

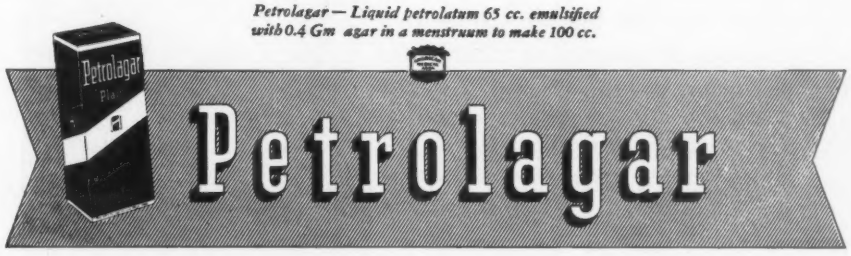
EDUCATION

Physicians who teach correct bowel management to their patients will appreciate the value of the new "Habit Time" booklet as a means of impressing patients with the importance of bowel regularity.

"Habit Time," written for doctors' patients in a clear, interesting style, embraces a discussion on diet, exercise and bowel regularity, in addition to a simple explanation of the functions of digestion.

"Habit Time," illustrated by Tom Jones, celebrated anatomical artist, has been reviewed and accepted by the Council on Pharmacy and Chemistry of the American Medical Association. It is offered, free, by Petrolagar as an aid to doctors . . . Petrolagar Laboratories, Inc., Chicago, Illinois.

Petrolagar — Liquid petrolatum 65 cc. emulsified with 0.4 Gm agar in a menstruum to make 100 cc.



ADEQUATE IRON
for Hypochromic Anemia

Excellent hemoglobin response results in most cases from the daily dose of three Hematinic Plastules Plain. This provides 15 grains of ferrous iron.

Small dosage, easy assimilation and toleration favor the use of Hematinic Plastules for hypochromic anemia, because they produce maximal results, at low cost, without discomfort or inconvenience to the patient.

Hematinic Plastules provide ferrous iron and the vitamin B complex of concentrated yeast, in soluble gelatin capsules. They are issued in two types—in bottles of fifty—Hematinic Plastules Plain and Hematinic Plastules with Liver Concentrate.

THE BOVININE COMPANY • CHICAGO, ILL.

EVALUATION and comparison are the natural processes by which the physician selects his armamentarium. Lilly pharmaceuticals and biologicals are offered solely on their merits, and are supported by more than sixty years of research and pharmaceutical experience. The Lilly trademark stands today, as in the past, for co-operation with the medical profession in unprejudiced evaluation of therapeutic agents.

CARBARSONE

New cases of amebiasis and of amebic dysentery are likely to be discovered during summer months. Carbarsone provides effective treatment. This pentavalent arsenical is unusually safe to administer.

Carbarsone, Lilly, is supplied in Pulvules (filled capsules) and Tablets, for oral use, and in Substance for preparation of therapeutic enemas. Carbarsone Suppositories are available for the treatment of trichomonas vaginalis vaginitis.

ELI LILLY AND COMPANY
INDIANAPOLIS, INDIANA, U. S. A.

SUNBURN

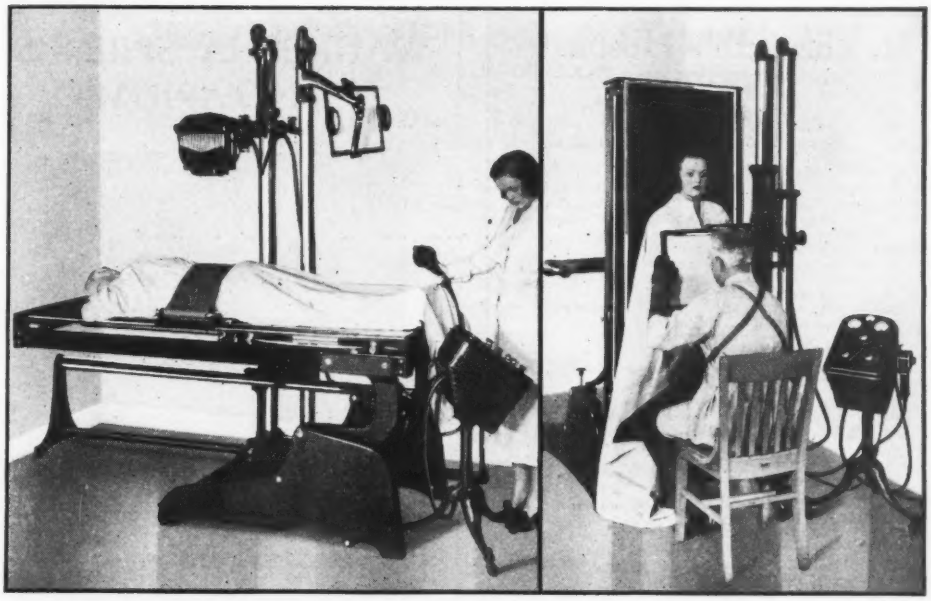
"Sunburn is a pain in the crest. Every time I slap one of these sunburn-babies, it makes me boil. Why don't they use NUPERCAINAL* and we'd both cool off?"

Why not help keep the waves cool and the girls calm. Recommend NUPERCAINAL, the smooth local anesthetic ointment that speedily takes the pain and itch out of sunburn. Many a grateful patient has thanked the physician for its prolonged relief and aid in earlier recovery.

NUPERCAINAL is packaged in tubes of one ounce and jars of one pound.

CIBA PHARMACEUTICAL PRODUCTS, Inc.
SUMMIT, NEW JERSEY

*Trade Mark Reg. U. S. Pat. Off.



New! **THE GENERAL ELECTRIC MODEL D3-38 IN ITS RANGE, AN UNSURPASSED VALUE**

An Efficient, Compact, Flexible, Combination Diagnostic X-Ray Unit

HERE—*completely new in every respect*—is a modern combination radiographic and fluoroscopic unit that will set another G-E record for *efficiency, ease of operation, flexibility, convenience and economy.*

With its wide range of service, its new, refined, simplified control unit, its flexible, easy-to-operate tilt table with built-in Bucky, the G-E Model D3-38 offers you *bigger dollar-for-dollar value* than any comparable equipment. With it, you can routinely produce *uniformly high quality results,* and accurately duplicate them with ease.

Never before has it been possible for you to own, and at a surprisingly moderate investment, an x-ray unit of this type having the capacity, range, and refinements of G-E's new D3-38. Correctly designed and engineered, solid and sound in every inch and part, you can depend on it to give long, satisfactory service, and to be an economical investment. *Before you invest in any x-ray, investigate this fine new unit.* Just clip, sign, and mail the handy coupon, today.

WITHOUT OBLIGATION

GENERAL ELECTRIC X-RAY CORPORATION

2012 JACKSON BOULEVARD CHICAGO, ILLINOIS

Please send me complete information about the new G-E Model D3-38 Combination Diagnostic X-Ray Unit.

A-7

Name.....

Address.....

City.....

St. Elizabeth's Hospital

RICHMOND, VIRGINIA

Staff

J. Shelton Horsley, M.D., Surgery and Gynecology
John S. Horsley, Jr., M.D., Plastic and General Surgery
Guy W. Horsley, M.D., General Surgery and Proctology
Douglas G. Chapman, M.D., Internal Medicine
Wm. H. Higgins, M.D., Consultant in Internal Medicine
Austin I. Dodson, M.D., Urology
Fred M. Hodges, M.D., Roentgenology
L. O. Snead, M.D., Roentgenology
R. A. Berger, M.D., Roentgenology
Howell F. Shannon, D.M.D., Dental Surgery
Helen Lorraine, Medical Illustration

Assistant Attending Staff

Harry J. Warthen, Jr., M.D., Surgery
W. K. Dix, M.D., Internal Medicine
J. P. Baker, Jr., M.D., Internal Medicine
Marshall P. Gordon, Jr., M.D., Urology
Chas. M. Nelson, M.D., Urology

Administration

N. E. Pate..... Business Manager

- The operating rooms and all of the front bedrooms are now completely air-conditioned.

SCHOOL FOR NURSES

The Training School is affiliated with **Johns Hopkins Hospital** in Baltimore for a three months' course each in Pediatrics and Obstetrics.

Address:
DIRECTOR OF NURSING EDUCATION

WAUKESHA SPRINGS SANITARIUM

For the Care and Treatment of

NERVOUS DISEASES

Building Absolutely Fireproof

BYRON M. CAPLES, M.D., Medical Director

Waukesha, - - - - Wisconsin

THE TUCKER SANATORIUM, INC.

212 West Franklin St. (Corner of Madison)

RICHMOND, VIRGINIA

This is the private Sanatorium for the Neurological Practice of Drs. Beverley R. Tucker, Howard R. Masters and James Asa Shield.

The Tucker Sanatorium is for the treatment of nervous and endocrine diseases. There are departments of massage, medicinal exercises, hydrotherapy and physiotherapy. The Sanatorium is large and bright, surrounded by a lawn and shady walks, large verandas and has a roof garden. It is situated in the best part of Richmond and is thoroughly and modernly equipped. The nurses are specially trained in the care of nervous cases.

Saint Albans Sanatorium

RADFORD, VA.

A modern, ethical institution, fully equipped for the diagnosis, care and treatment of nervous and mental diseases and selected addiction cases. 2,000 feet elevation. Rates reasonable. Occupational and Hydrotherapy Departments.

J. C. KING, M.D. JAMES KING, M.D.
FRANK A. STRICKLER, M.D.

DR. MOODY'S SANITARIUM

SAN ANTONIO, TEXAS

315 Brackenridge Avenue Phone: Fannin 5522

For Nervous and Mental Diseases, Drug and Alcohol Addiction and Nervous Invalids Needing Rest and Recuperation

Established 1903. Strictly ethical. Location delightful summer and winter. Approved diagnostic and therapeutic methods. Seven buildings, each with separate lawns, each featuring a small separate sanitarium, affording wholesome restfulness and recreation, in doors and out doors, tactful nursing and homelike comforts.

G. H. MOODY, M.D.
Founder

J. A. McINTOSH, M.D., F.A.C.P.
Superintendent

Hoye's Sanitarium

"In the Mountains of Meridian"

MERIDIAN, MISS.

Diagnosis and Treatment of Nervous and Mental Diseases, Alcoholic and Drug Addictions, Convalescents and Elderly People. New addition with private baths. New Hydrotherapeutic Department. Trained psychiatrist to give Insulin Treatment for Dementia Praecox. Rates reasonable.

Dr. M. J. L. Hoye, Supt.,
Formerly sixteen years Superintendent of East Mississippi State Hospital.

McGUIRE CLINIC

ST. LUKE'S HOSPITAL

Richmond, Virginia

. . . Medical and Surgical Staff . . .

General Medicine:
James H. Smith., M.D.
Hunter H. McGuire, M.D.
Margaret Nolting, M.D.
John P. Lynch, M.D.

Orthopedic Surgery:
William T. Graham, M.D.
D. M. Faulkner, M.D.
J. T. Tucker, M.D.

General Surgery:
Stuart McGuire, M.D.
W. Lowndes Peple, M.D.
Carrington Williams, M.D.
W. P. Barnes, M.D.
G. D. Vermilya, M.D.

Pathology and Radiology:
S. W. Budd, M.D.

Roentgenology:
J. L. Tabb, M.D.

Obstetrics:
H. Hudnall Ware, Jr., M.D.
H. C. Spalding, M.D.

Urology:
Austin I. Dodson, M.D.

Eye, Ear, Nose and Throat:
F. H. Lee, M.D.

Dental Surgery:
John Bell Williams, D.D.S.
Guy R. Harrison, D.D.S.

Alcoholism
Senility
Drug Addiction

A Modern Ethical Hospital at Louisville

Founded 1904

Mental and Nervous Diseases

BEAUTIFUL AND SPACIOUS GROUNDS AFFORD OUTDOOR RELAXATION

Our **ALCOHOLIC** treatment destroys the craving, restores the appetite and sleep, and rebuilds the physical and nervous condition of the patients. Whiskey withdrawn gradually; no limit on the amount necessary to prevent or relieve delirium.

MENTAL patients have every comfort that their home affords.

The **DRUG** treatment is one of gradual reduction; it relieves the constipation, restores the appetite and sleep; withdrawal pains are absent. No Hyoscine or rapid withdrawal methods used unless patient desires same.

NERVOUS patients are accepted by us for observation and diagnosis, as well as treatment.

Select cases of SENILITY accepted. **Physiotherapy—Clinical Laboratory—X-Ray.** **Consulting Physicians.**

Rates and folder on request

THE STOKES HOSPITAL

Telephone Highland 2101

E. W. STOKES, M.D., Medical Director, 923 Cherokee Road, Louisville, Ky.

Dr. Brawner's Sanitarium

SMYRNA, GEORGIA
(Suburb of Atlanta)

● *For Nervous and Mental Disorders, Drug and Alcohol Addictions*

Approved diagnostic and therapeutic methods. Hydrotherapy, Electrotherapy, Massage, X-ray and Laboratory.

Special Department for General Invalids and Senile Cases at Monthly Rates.

JAMES N. BRAWNER, M.D., Medical Supt.
ALBERT F. BRAWNER, M.D., Resident Supt.

WESTBROOK SANATORIUM

Richmond ***Virginia***

TELEPHONE: 5-3245

Department for Men:
J. K. Hall, M.D.

Associates:
O. B. Darden, M.D.
E. H. Alderman, M.D.
E. H. Williams, M.D.
Rex Blankinship, M.D.

Department for Women:
P. V. Anderson, M.D.

The institution is situated just beyond the northern border of the city on United States Highway Number 1.

The scope of the work of the Sanatorium is limited to the diagnosis and the treatment of nervous and mental disorders and to the addictions to drugs and to alcohol. It affords also adequate facilities for rest and upbuilding under medical and nursing supervision.

The medical staff devotes its entire attention to the patients in the Sanatorium.

The institution maintains a school for trained attendants in which instruction in the care of the nervous and mentally sick is emphasized.

There are twelve separate buildings for patients, with 150 beds. Such a large group of buildings makes possible the more congenial grouping of patients. Rooms may be had single or en suite, with or without private bath. There are a few small cottages for the use of individual patients.

A comprehensive general physical and nervous examination is made of each patient. A mental examination is made when indicated. The examination is typed and a copy of it is available for the referring physician. Complete dental investigation is a part of the general survey.

A skilled teacher gives practical daily instruction to small groups in the arts and crafts. Helpful and interesting occupation in the out-of-doors is made possible for the men patients in the vegetable and flower gardens, on the truck farm, in the poultry yards, and in the dairy.

There are bowling, tennis, croquet and pool. On Sunday evening there is chapel service.

Detailed information is available for physicians.

STUART CIRCLE HOSPITAL

Richmond, Virginia

Medicine:
ALEXANDER G. BROWN, JR., M.D.
OSBORNE O. ASHWORTH, M.D.
MANFRED CALL, III, M.D.
M. MORRIS PINCKNEY, M.D.
ALEXANDER G. BROWN, III, M.D.

Obstetrics:
GREER BAUGHMAN, M.D.
BEN H. GRAY, M.D.
WM. DURWOOD SUGGS, M.D.

Ophthalmology, Otolaryngology:
CLIFTON M. MILLER, M.D.
R. H. WRIGHT, M.D.
W. L. MASON, M.D.

Pediatrics:
ALGIE S. HURT, M.D.
CHAS. PRESTON MANGUM, M.D.

Surgery:
CHARLES R. ROBINS, M.D.
STUART N. MICHAUX, M.D.
ROBERT C. BRYAN, M.D.
A. STEPHENS GRAHAM, M.D.
CHARLES R. ROBINS, JR., M.D.

Urological Surgery:
JOSEPH F. GEISINGER, M.D.

Oral Surgery:
GUY R. HARRISON, D.D.S.

Pathology:
REGENA BECK, M.D.

Roentgenology and Radiology:
FRED M. HODGES, M.D.
L. O. SNEAD, M.D.
R. A. BERGER, M.D.

Physiotherapy:
ELSA LANGE, B.S., Technician,
MARGARET CORBIN, B.S., Technician

Medical Illustrator:
DOROTHY BOOTH

Stuart Circle Hospital has been operated twenty-four years, affording scientific care to patients in General Medicine, Surgery, Obstetrics and the various medical and surgical specialties. Detailed information furnished physicians.

CHARLOTTE PFEIFFER, R. N., Superintendent

CITY VIEW SANITARIUM

For MENTAL and NERVOUS DISEASES and ADDICTIONS

ESTABLISHED IN 1907
AN ENTIRELY NEW PLANT ERECTED IN 1922

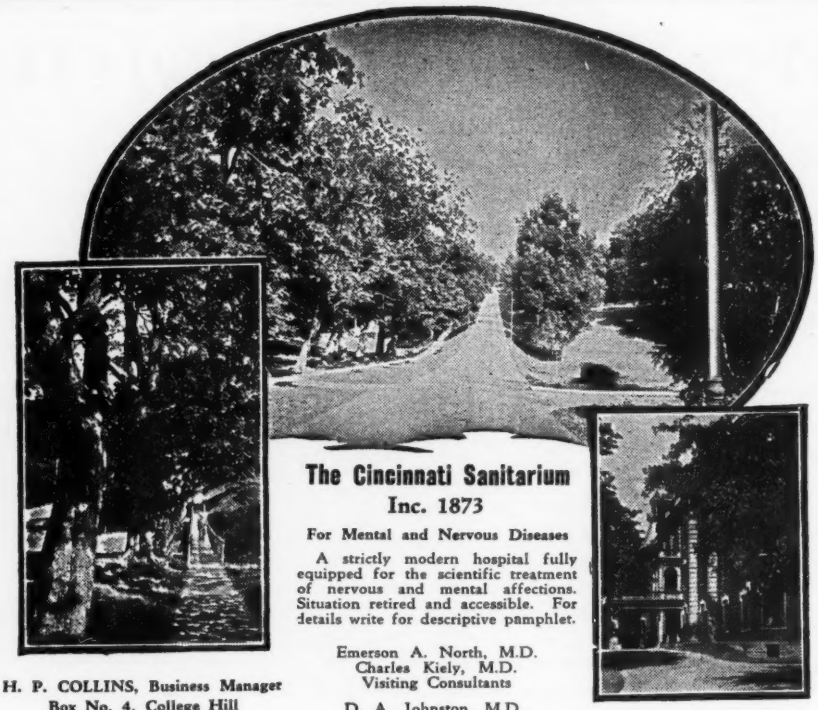
Separate buildings for men and women, ideally arranged and equipped with every facility for the comfort, care and treatment of the class of patients received. Situated in the midst of a fifty-acre tract, and surrounded by large groves and attractive lawns. Two resident physicians. Training school for nurses.

References: The Medical Profession of Nashville

JOHN W. STEVENS, M.D., Physician-in-Charge

NASHVILLE R. F. D. No. 1 TENNESSEE

On Murfreesboro Pike, one-half mile east of old location



The Cincinnati Sanitarium

Inc. 1873

For Mental and Nervous Diseases

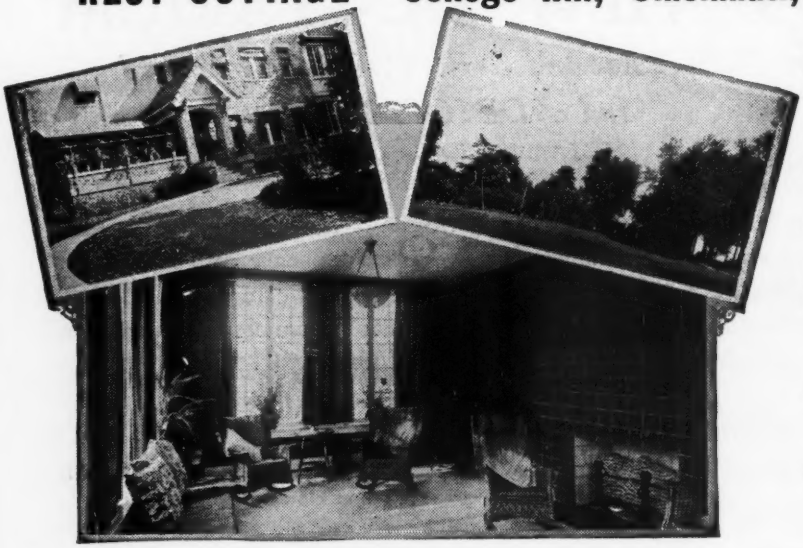
A strictly modern hospital fully equipped for the scientific treatment of nervous and mental affections. Situation retired and accessible. For details write for descriptive pamphlet.

Emerson A. North, M.D.
Charles Kiely, M.D.
Visiting Consultants

D. A. Johnston, M.D.,
Medical Director

H. P. COLLINS, Business Manager
Box No. 4, College Hill
CINCINNATI, OHIO

"REST COTTAGE" College Hill, Cincinnati, Ohio



For purely nervous cases, nutritional errors and convalescents.

Completely equipped for hydrotherapy, massages, etc.

Cuisine to meet individual needs.

Emerson A. North, M.D.
Charles Kiely, M.D.
Visiting Consultants

D. A. Johnston, M.D., Medical Director

H. P. Collins, Bus. Mgr., Box No. 4, College Hill, Cincinnati, Ohio

HILL CREST SANITARIUM

FOR NERVOUS AND MENTAL DISEASES AND ADDICTIONS

Established in 1925

A NEW PLANT WAS COMPLETED IN 1930

Thoroughly modern in architecture and construction. Eight departments—affording proper classification of patients. All outside rooms, attractively furnished. Several bathrooms and rooms with private bath on each floor. Also a spacious sun parlor in each department. Located on the crest of Higdon Hill, 1050 feet above sea level, overlooking the city, and surrounded by an expanse of beautiful woodland. Ample provision made for diversion and helpful occupation. Adequate night and day nursing service maintained.

JAMES A. BECTON, M.D., Physician-in-Charge

P. O. Box 96, Woodlawn Station, Birmingham, Ala. Phones: 9-1151 and 9-1152

Consultants: C. M. Rudulph, M.D.; H. S. Ward, M.D.; W. S. Littlejohn, M.D.

WALTER R. WALLACE, M.D. HUGH W. PRIDDY, M.D.

THE WALLACE SANITARIUM

MEMPHIS, TENN.

For the treatment of Drug Addiction, Alcoholism, Mental and Nervous Diseases.
Fully equipped for the care of patients admitted. Sixteen acres of beautiful grounds.
Located in the eastern suburbs of the city at Southern Avenue and Cherry Road.

Behind MERCUROCHROME

(dibrom-oxymercuri-fluorescein-sodium)

H W & D *is a background of*

Precise manufacturing methods insuring uniformity

Controlled laboratory investigation

Chemical and biological control of each lot produced

Extensive clinical application

Seventeen years' acceptance by the Council of Pharmacy and Chemistry of the American Medical Association

A booklet summarizing the important reports on Mercurochrome and describing its various uses will be sent to physicians on request.

HYNSON, WESTCOTT & DUNNING, Inc., Baltimore, Md.

Theocalcin

Council Accepted

In Congestive Heart Failure

For the reduction of edema and to diminish dyspnoea, give 1 to 3 tablets of Theocalcin, three times a day. Theocalcin, theobromine-calcium salicylate is a well-tolerated diuretic and myocardial stimulant for oral administration.

Available as 7½ grain tablets and in powder form.

Bilhuber-Knoll Corp. 154 Ogden Avenue JERSEY CITY, N. J.

SOUTHERN MEDICAL JOURNAL

JOURNAL OF THE SOUTHERN MEDICAL ASSOCIATION

PUBLISHED MONTHLY BY THE SOUTHERN MEDICAL ASSOCIATION AT BIRMINGHAM, ALA.

Volume 31 JULY 1938 Number 7

THE PHYSIOLOGIC APPROACH TO THE CORRECTION OF CONSTIPATION*

By P. B. WELCH, M.D., F.A.C.P.
and
F. H. KAUDERS, M.D.
Miami, Florida

It is obvious that in the presence of constipation there must co-exist an underlying disturbance in the function of the colon. Consideration of the problem of constipation should, therefore, consist primarily of a consideration of the nature and extent of the associated functional disturbance in each case.

The clinical results of a routine physiologic approach to the problem of constipation over a period of years have been so uniformly satisfactory that the following postulate seems justified:

In the absence of mechanical obstruction, the application of available knowledge of the physiology of the colon can correct chronic constipation in virtually every case where the nervous and metabolic mechanism is intact and where even a small residue of expulsive forces remains.

This presentation is confined chiefly to factors influencing the muscular activity of the colon.

The colon has a relatively low but widely variable degree of motor irritability and excitability; its peristaltic beat is deliberate and its tone changes are almost larval. Despite this, the muscular activity of the colon is influenced by an amazing number of factors both intrinsic and extrinsic.

*Read in Section on Gastroenterology, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

*From Research Department, Jackson Memorial Hospital, Miami, Florida.

EXTRINSIC FACTORS INFLUENCING THE MUSCULAR ACTIVITY OF THE COLON

It has been shown clinically and experimentally that (1) taking food, (2) stimuli from adjacent viscera, (3) psychic stimulation, (4) metabolic and allergic disturbances, (5) bodily and mental activity and sleep may markedly affect the muscular activity of the colon.

(1) *Taking Food.*—Hurst,[1] Zondek[2] and others showed that the taking of food caused marked stimulation of the colon musculature.

It has been shown[3] that this reflex was dependent upon the taste or smell or thought of food, an appetite or taste reflex and not a gastrocolic reflex. This reflex plays an important role in the management of constipation and is perhaps the most potent extrinsic factor in normally stimulating propulsive contractions in the colon and is the factor chiefly responsible for the usual defecation after eating, in normal animals and humans.

(2) *Stimuli from Adjacent Viscera.*—It has been shown by Surmont, Dubus and Tiberghien[4] that it is possible to produce contractions in the colon by stimulation of the duodenum or pyloric region. Tixier and Clavel[5] showed that stimulation of the kidney and kidney peritoneum caused tone changes in the colon. It has been shown[6] that trauma applied to the ureter and kidney pelvis as well as the urethra caused marked tone changes with late appearance of painful contractions in the colon.

Clinically, it has been observed that lesions about the anus, corpus or cervix uteri and adnexa, bladder, urethra, ureters, appendix, gall bladder or any part of the digestive tube, particularly the anus, reflexly produce changes in the muscular activity of the colon, usually increasing tonus and peristalsis. All of these must be considered as potential factors in the production of constipation because of their demonstrated in-

Fig. 1

Dog's colon, showing (B), increased muscular activity stimulated by the taking of food by mouth (feeding reflex). (A) shows the absence of the feeding effect when fed through a gastric fistula, showing that this reflex is not a gastrocolic reflex, but a true appetite or taste reflex.

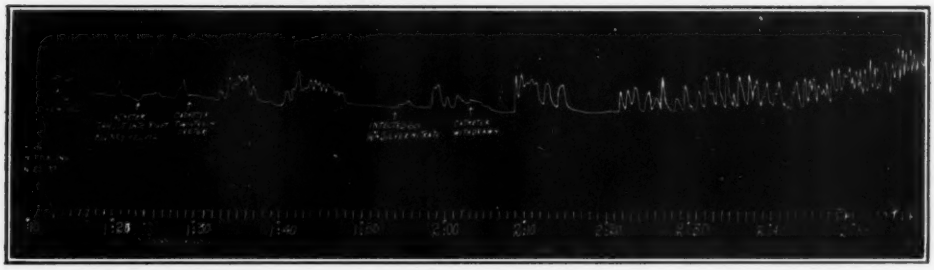


Fig. 2

Tracing of normal human colon showing increase in peristalsis and tone associated with trauma to the right ureter. Twisting of the catheter in the ureter caused painful contractions to occur in the colon on the left side of the abdomen. Injection of 6 c. c. of 0.5 per cent silver nitrate caused further increase in muscular activity of the colon consisting of tone changes and painful contractions. These continued until they reached such severity as to require an opiate. The painful contractions in the colon occurred with pain in the right kidney tract and independent of the pain in the right kidney tract.

fluence upon the muscular activity of the normal colon.

(3) *Effect of Psychic Stimuli.*—It has long been known that strong emotional stresses may cause violent muscular activity of the colon, resulting even in involuntary defecation or diarrhea. Clinically, it has been repeatedly observed that worry or anxiety markedly influenced the excretory function of the colon. It has been shown that during sleep the muscular activity of the colon is minimal. Correction of the mental state is frequently a most important phase in the management of chronic constipation.

(4) *Metabolic and Allergic Disturbances.*—The scope of this paper does not permit more than passing mention of the constipation associated with hypothyroidism, the diarrhea of thyrotoxicosis, the diarrhea and constipation of achylia and in allergic states, the imbalance between the sympathetics and parasympathetics with its associated change in the activity of the colon musculature. When present, their correction is obviously necessary to normal colon function.

Virtually all the extrinsic factors above outlined cause an increase in muscular activity, consisting of increased tone and increase in frequency and amplitude of colon contractions. Despite this increased muscular activity, constipation is a usual associate. It is at first difficult to reconcile an increased muscular activity with a delay in the passage of fecal residues through the colon. These conditions probably represent those found in the so-called "spastic colon", or "unstable or irritable colon" with stasis.

It is quite possible that the association of constipation with this obviously increased muscular activity may be due to the type of contractions occurring.

Larson and Bargen[7] by making simultaneous tracings of the proximal, mesial and distal portions of isolated intact dogs' colons, demonstrated the occurrence of a regular pulsating type of wave in which the entire organ contracts systolically as a single unit, with the exception of the cecum. In this type of contraction, there is no propulsive action upon the fecal content.

Similar extensive pulsating tonal changes have

frequently been seen during fluoroscopic observations of barium enemas. Relatively long segments of the descending and distal transverse colon may repeatedly and simultaneously undergo uniform narrowing without segmentation or evidence of propulsive peristalsis. These periods of contraction alternate with longer periods of relaxation, the whole tonal beat or pulsation requiring approximately one to three minutes.

This evidence would tend to confirm the prevalent idea that virtually all constipation is "spastic." In the cases in which constipation is produced by factors outside the colon, increased tone in segments of the colon doubtless is largely responsible for the stasis.

Fig. 3

X-ray photograph of colon showing extensive tonal changes in descending and transverse colon, associated with extracolic disease (infected stump of cervix uteri).

INTRINSIC FACTORS INFLUENCING MUSCULAR ACTIVITY OF THE NORMAL COLON

The intrinsic factors are concerned chiefly with the character and amount of material occupying the lumen of the colon.

The increase of muscular activity of the colon produced by irritant substances within its lumen is so well known as to justify but passing mention. The majority of cathartics fall within this category of irritant substances. Excessive roughage diets should also be included.

Effect of Distention.—It has been shown[3] that the appetite reflex is not excited in the colon when it is empty but is invariably present when the colon is normally full of fecal residues.

Further studies have recently been made by one of us[8] upon the effect of distention of the normal colon. It was shown that increase in pressure by balloons placed within the colon invariably increased the tone and frequency and amplitude of peristaltic contractions. The increase in the muscular activity of the colon was proportional to the increase in hydrostatic pressure within the lumen and associated stretching of the bowel wall.

The changes varied from a moderate increase in tone and frequency and amplitude of contractions to a continuous activity and constant rapid and extensive contractions with well marked tone changes, as shown in *Fig. 4.*

The degree of response to distention varied in different normal colons and also in the same

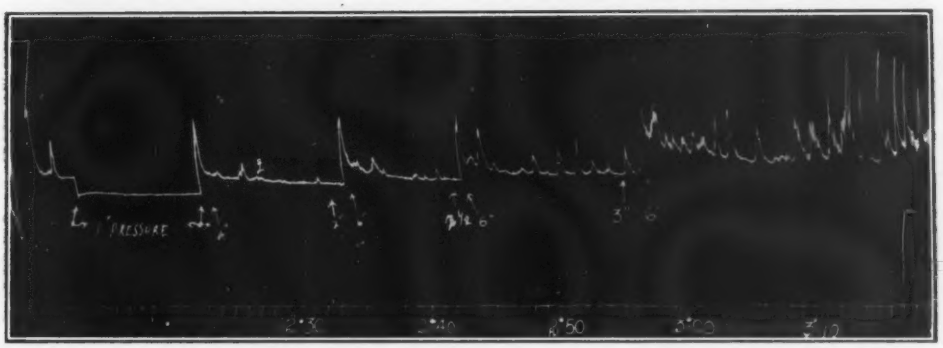


Fig. 4

Showing the resting colon with one-inch pressure. As the pressure is increased to two, two and one-half, three and six inches, there is shown an increase in muscular activity, approximately proportional to the increased intraluminal pressure.

colon at different times but was always similar in character.

Prolonged Distention of Normal Colon.—It was noted that with prolonged distention, the irritability of the normal colon gradually lessened, the tonus slowly lowered, the intervals of contractions were of shorter duration and less extensive until usually within one and one-half to two hours the tracing resembled a resting colon, despite the continued distention of the colon wall.

This suggested a loss of irritability of its neuromuscular apparatus, or a raising of its threshold of irritability to stimuli.

If this hypothesis were correct, it would signify that habitual overdistention of the colon, probably in any part, would result in a non-spastic stasis due to loss of its tone and peristalsis. Under such circumstances, the habitual overfilling of the static colon by means of high residue and roughage diets would seem to be a very questionable procedure.

Stasis predicated upon this loss of irritability of the colon neuromuscular apparatus does not constitute spasm and the generally accepted idea that all constipation is spastic must be revised.

In the present investigations of the muscular activity of the colon, it was found that frequently the same colon upon different days, using the same technic in recording, responded quite differently. In one tracing, the colon might be very active; on another occasion the same colon would be very quiet. This is probably explained upon varying levels of the threshold of irritability.

The threshold of irritability was almost uniformly high after defecation, with minimal muscular activity. After vomiting, the colon contractions were quiescent; apparently there exists a latent period of varying duration following periods of maximum activity of the musculature. Thereafter, there apparently is a slow building up or summation of irritability resulting eventually in another phase of muscular activity. This hypothesis was further borne out by tracings made in diseased colons where a demonstrable inflammatory condition of the mucosa and probably submucosa existed. It was shown that not only did relaxation not occur after prolonged distention but there was an actual progressive increase in irritability of the colon till it reached almost explosive proportions, as evidenced by violent and painful contractions and occasionally nausea and vomiting, followed immediately by varying periods of relaxation.

Frequently it was with difficulty that the recording balloon was retained in the colon because of the violence of these contractions. Distention over a period of three hours showed no lessening of activity, definite evidence that the muscular response of the colon to distention is predicated upon the threshold of irritability of its neuromuscular apparatus and not muscle fatigue.

In the light of these findings, it seems reasonable to assume that constipation in many instances is due to loss of irritability in the colon rather than spasm.

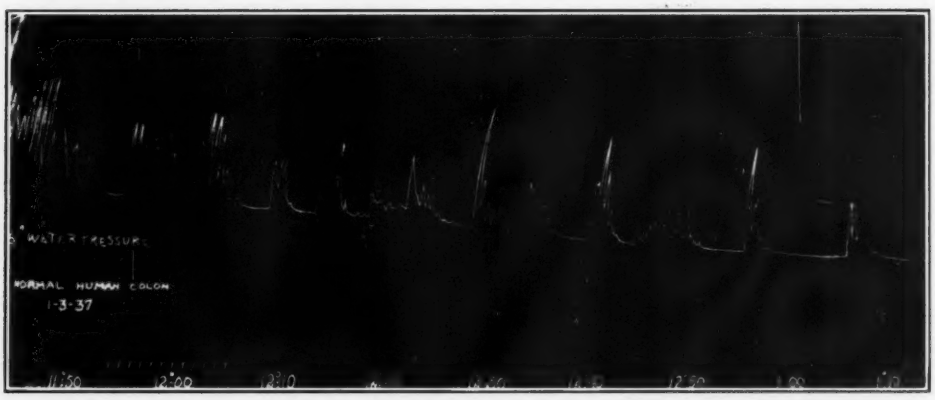


Fig. 5

Tracing of the normal human colon showing the effect of prolonged distention upon the muscular activity, consisting of wider intervals between peristaltic contractions and a gradual slow loss of tone, wider resting intervals between periods of contraction.

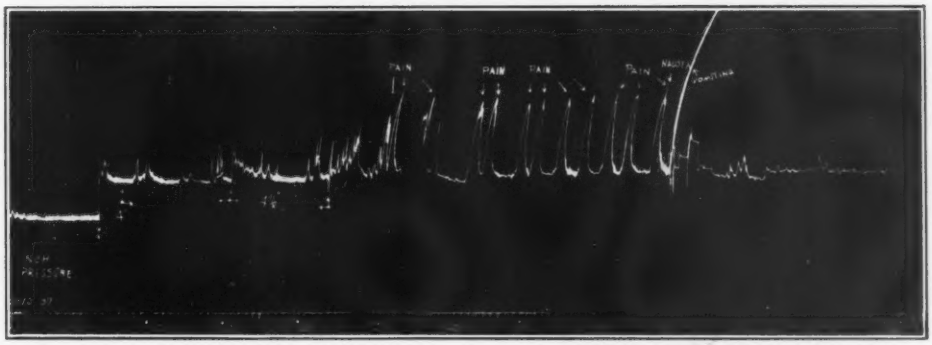


Fig. 6

Effect of prolonged increased intraluminal pressure in a diseased colon. With one-inch pressure, the colon was quiescent; as the pressure within the colon was increased there was a building up, or summation, of colon irritability with painful contractions, culminating in vomiting. The vomiting was followed by an apparent loss of irritability and relaxation of the colon musculature.

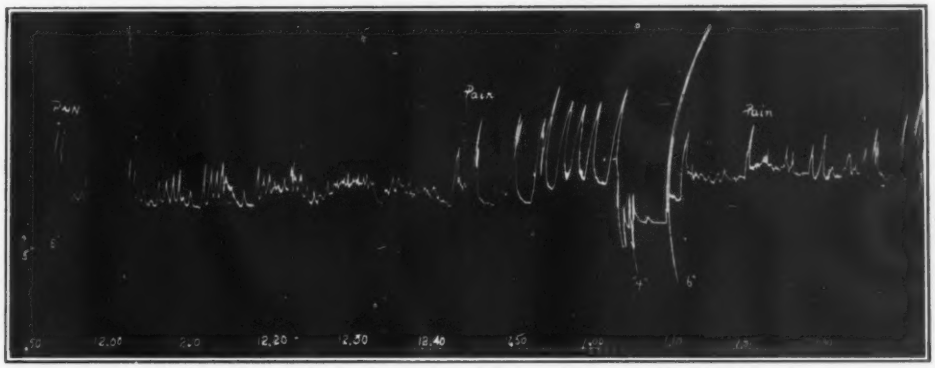


Fig. 7

Shows the effect of prolonged distention upon the diseased colon, an apparent summation of irritability with continuous increase in tone with rapidly recurring periods of peristaltic activity. There was no relaxation with prolonged distention, demonstrating that the relaxation in the normal colon as shown in *Fig. 5* is not due to muscle fatigue, but is probably dependent upon alteration of the threshold of irritability.

This assumption is further exemplified by the frequency with which wide distention of the entire colon is observed, without discomfort, during administration of a barium enema. In this type of case the colon quickly accommodates itself to the bulk of the enema, peristalsis is seldom visualized and tonal changes are so slight as usually to escape notice, as shown in *Fig. 8*.

This case represents the typical hypotonic static colon. There exists no valid evidence that spasm plays any part in this type of stasis. It is doubtless predicated upon a loss of irritability of the neuromuscular apparatus of the colon.

Assuming that constipation is frequently predicated upon a loss of irritability and not spasm, the logical approach to relief should be one aimed at raising the irritability by normally filling the colon with a soft, smooth, non-irritant fecal residue with sufficient bulk to stimulate normal peristalsis, without irritation or undue distention.

Just as a normal colon can be calloused by the injudicious use of cathartics, so can the overstimulated overdistended colon be surprised into normal function by the removal of all irritants. The irritability can be again restored to a normal level and almost invariably normal defecation will be re-established within a period of three days to three weeks.

CLINICAL APPLICATION

Obviously the correction of chronic constipa-

Fig. 8

X-ray photograph of a hypotonic colon showing wide distention throughout its entire extent without discomfort to the patient nor desire to defecate.

tion must include a consideration of all the factors influencing the muscular activity of the colon, extrinsic as well as intrinsic.

A routine procedure has been evolved for the correction of chronic constipation predicated upon available knowledge of the physiology of the muscular activity of the colon.

This procedure consists of three major prerequisites:

(1) A complete survey of the entire body with the recognition and correction of all sources of infection, visceral irritation and metabolic or allergic disturbances. This is particularly important in the so-called "spastic" or hypertonic constipation.

(2) Control of the colon content to produce normal distention without irritation. This is obtained by a simple dietetic regimé in which relatively low residue, bland, non-putrefactive foods are prescribed, with adequate fluid intake. This regimé is of benefit in both the hypertonic and hypotonic types of constipation.

(3) The repeated initiation of the feeding reflex by giving frequent, relatively small feedings. The patient is instructed to chew each mouthful of food to creamy consistency to obtain the fullest utilization of the appetite or taste reflex. These frequent feedings of easily digested foods have the additional merit of giving the whole digestive tract as near an approximation of physiologic rest as possible, avoiding overloading of the stomach, small intestine and colon.

In addition to the foregoing, the usual instructions are given as to habit time for defecation, with the assurance that although all cathartics have been discontinued, normal defecation will be re-established within a period of three days to three weeks.

SUMMARY

It has been shown that the muscular activity of the colon is influenced by a large number of factors, extrinsic as well as intrinsic; that the muscular activity of the colon is increased by stimuli from adjacent viscera, a viscerovisceral reflex.

It has been shown that the muscular activity of the colon is influenced by psychic stimuli, metabolic and allergic disturbances and that when the colon is normally full, the taste of food constitutes the strongest normal stimulus to propulsive muscular activity.

It has been shown that the normal colon responds to distention by an increase in muscular activity and that prolonged distention in the normal colon results in a loss of irritability of the neuromuscular apparatus of the colon.

It has been shown that this loss of irritability upon prolonged distention does not occur in the diseased colon. This demonstrates that the diminution of activity in the normal colon is not due to fatigue of smooth muscle but due to an alteration in the threshold of irritability of its neuromuscular apparatus.

It has been postulated that the raising of the threshold of irritability of the neuromuscular apparatus of the colon probably constitutes a major etiologic factor in the production of chronic constipation and that this type of constipation is definitely not due to spasm but is due to hypotonicity.

The prevalent idea that virtually all constipation is spastic in origin must be revised. Spastic constipation does exist and in the authors' experience has very frequently been associated with extra-colic visceral disease, particularly the genito-urinary tract and the anus. A simple method of management has been outlined predicated upon the known factors influencing the motor function of the colon.

BIBLIOGRAPHY

1. Hurst: Jour. Physiol., **47**:57, 1913.
2. Zondek: Arch. f. Verdauungs-Krank., **27**:18, 1920-1921.

3. Welch and Plant: Amer. Jour. Med. Sci., **121**:261, 1926.
4. Surmont, Dubus and Tiberghien: Comp. rend. Soc. de Biol., Paris, **71**:641, 1911.
5. Tixier and Clavel: Surg., Gyn. & Obst., **54**:505-510, 1932.
6. Welch, Holmes and Coplan: Amer. Jour. Dig. Dis. & Nut., **4**: 797-802 (Feb.) 1938.
7. Larson and Bargen: Arch. Surg., **27**:1130-1145 (Dec.) 1933.
8. Welch: Amer. Jour. Dig. Dis. & Nut., **4**:382-386 (Aug.) 1937.

DISCUSSION (*Abstract*)

Dr. C. W. Dowden, Louisville, Ky.—It is not surprising that irritation of any hollow tube which contains longitudinal and circular muscles, a mucous membrane, and is covered by peritoneum and innervated by two sets of delicately balanced nerves will produce a great variety of responses. The problem becomes more complex, however, when the origin of the irritation, which is both somatic and psychic, is considered. We are familiar with the abdominal symptoms that occur in renal and ureteral calculi, the pneumonias in children, cholecystic and appendical disease, and how frequently constipation is relieved by removal of a distant source of irritation. Dr. Welch furnishes graphic proof of this. His work also casts doubt on the presence of a gastrocolic reflex. I am fearful, however, that his conclusion, that the character and quantity of content in the lumen of the colon is the most potent factor in governing the character of muscular response may find some opposition.

The colon is similar to other hollow organs, such as the bladder, that depend upon muscular irritation and contraction to evacuate their contents. With increasing distention there is increased irritability and expulsive efforts of the muscular coat until a point is reached that the contractile power is entirely lost, and then follows physiologic paralysis of the muscle with dilatation which sometimes goes on to rupture.

While I believe that the term spastic or irritable colon is much over-worked and often wrongly applied, I still believe that it probably accounts for a large majority of cases of simple constipation.

There is a feeling, also, that irrespective of the character of the bulk, the colon may elaborate a chemical that acts as an irritant to the muscle, such as purgative drugs do.

I am quite definitely of the opinion that disturbance of the mechanism which controls water balance accounts for many colopathies. In some the failure to remove water from the feces results in loose stools, or even diarrhea. In others, the so-called condenser-like function of the colon is too efficient, and the feces become too concentrated and small in bulk to act as a proper stimulus to defecation.

Among the other numerous somatic causes of constipation are living conditions, nationality, familial characteristics, the rush to a highly competitive business, eating irregularly and hurriedly, improper intake of fluids, failure to respond to nature's call, and improper rest and sleep. And when we delve into the psyche, we soon meet what appears to be an unsurmountable wall of difficulties, hopeless and helpless to cure by restoring normal physiology of the colon. Among such psychic causes are nervous tension, anxiety, worry, introspection, family difficulties, fatigue, excitement, and even mental preoccupation. These, and others, stop the digestive processes so that food is not broken up into the normal chemical constituents.

Constipation or other functional abnormalities of the colon may, on final analysis, be the result of fluctuations in the stock market, or one's reaction to the New Deal.

Dr. Welch (closing)—We have shown that a gastrocolic reflex does not exist, but the so-called gastrocolic reflex is in reality an appetite or taste reflex. This work was confirmed by the investigations of Drs. Slive and Fogelson on "Colon Motility" published in the *American Journal of Digestive Diseases and Nutrition*, in March, 1937.

Dr. Dowden's reference to the patients' environment, mental and physical, familial characteristics and psychic reactions is a valuable one. All of these factors unquestionably affect the muscular activity of the colon, but do not offer insurmountable obstacles to the correction of constipation. In our experience, the individuals who have an apparently excessive condenser action in the colon constitute the most difficult problems. It is hoped that eventually our knowledge of the secretory and absorptive functions of the colon mucosa will offer a logical explanation and solution of this difficult problem.

INTESTINAL TUBERCULOSIS*

A PATHOLOGIC AND CLINICAL SURVEY

By CHARLES T. STONE, M.D., F.A.C.P.
and
LOYD W. SHECKLES, JR., M.D.
Galveston, Texas

Tuberculosis of the intestines is the most frequent and one of the most serious of the complications of pulmonary tuberculosis, occurring, according to different analyses, in from 50 to 80 per cent of all cases. Despite the importance which this fact bears to the question of tuberculosis in general, remarkably little is to be found in current literature on this phase of the disease. Just why this should be the case is not altogether clear, but certain facts may serve as a partial explanation. In the first place, every clinician who follows cases of tuberculosis to the autopsy table is frequently impressed by the finding of intestinal lesions in subjects who were never suspected of having them. Apparently this fact has created a feeling of helplessness on the part of many. Secondly, it is commonly held that the intestinal complications are always late occurrences in the course of advanced pulmonary tuberculosis, and therefore are of minimal significance. Finally, there is common acceptance of the idea that intestinal

*Read in Section on Gastroenterology, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30—December 1-2-3, 1937.

*From the Department of Practice of Medicine, University of Texas, and the Medical Service of the John Sealy Hospital, Galveston, Texas.

tuberculosis is not amenable to treatment. Such concepts have doubtless contributed largely to the apathy which seems to have dominated the attitude of physicians generally toward this subject.

Partly because of this lack of interest in what is in reality an important matter, and partly to ascertain the facts relative to our own cases, we have undertaken a study of all cases showing the lesions of intestinal tuberculosis in consecutive autopsies over the ten-year period from July, 1927, to July, 1937. There were performed during this time 2,220 postmortem examinations on patients dying in the John Sealy Hospital. Of this number 284, or 12.9 per cent, were found to have tuberculosis in some form, and 273, or 12.3 per cent, had pulmonary tuberculosis. Sixty, or 21 per cent of the total (284), had intestinal tuberculosis, or 22 per cent of the pulmonary cases (273).

MATERIAL FROM WHICH CASES IN THIS STUDY WERE DERIVED

In the ten-year period under consideration there was a total of 55,867 hospital patients, of which 10,545, or 18.9 per cent, were in the medical service. There were in this decade 739 medical cases with a diagnosis of tuberculosis in some form. Therefore, almost 40 per cent of all the hospital cases with tuberculosis during the period came to autopsy. It is not unreasonable to believe that an investigation of the 284 autopsy cases showing tuberculosis in some form with reference to the incidence of intestinal tuberculosis affords a fair insight into the status of those that were studied only from the clinical side. Of the 60 cases that showed enteric lesions of tuberculosis at autopsy, there were 30 whites and 30 Negroes, but since there were roughly two and one-fourth times as many white patients as there were Negroes in the hospital, the condition was somewhat more than twice as frequent in the colored race. Forty-two of the patients were males and 18 were females, although there were slightly more of the latter in the total number of hospital admissions.

The distribution of the cases by age groups in decades is tabulated below:

Under 10 years	3
10 to 19 years	4
20 to 29 years	21
30 to 39 years	9
40 to 49 years	8
50 to 59 years	10
60 to 69 years	2
70 to 79 years	2
Over 80 years	1
Total	60

From a study of the above figures it is at once obvious that the highest incidence of intestinal tuberculosis is from the third to the sixth decade inclusive, or roughly, the same as that of tuberculosis in general.

PATHOLOGIC DATA

In none of the 60 autopsy-proven cases of intestinal tuberculosis was the disease primary in the digestive tract. This coincides with the usual experience in the United States, in rather sharp contrast to that of reported series of cases from European clinics. Beitzke[1] cited 13 cases of primary tuberculosis of the intestine occurring in 1,100 autopsies performed at the Chartie Hospital in Berlin, and Heller,[2] of Kiel, found 2 examples of primary intestinal tuberculosis in 714 autopsies, 140 of which showed tuberculous lesions. Blalock,[3] of Glascow, collected 372 cases of tuberculosis (all forms) among 2,500 autopsies done on infants and children, and 22 of them had primary tuberculous enteritis. Similar reports are lacking almost entirely in the American literature, although there are a few observations, chiefly in children, but occasionally in adults, with the sole tuberculous disease in the mesenteric lymph nodes. This harmonizes with the well established belief that tubercle bacilli may pass through the wall of the intestine and cause infection of the mesenteric nodes without producing lesions in the gut itself. We found no such examples in our 284 cases, which included seven children.

Fifty-eight of the 60 cases showed pulmonary tuberculosis. In 48 it was far advanced; it was moderately advanced in 8, and minimal in 2. Cavitation was present in 52 of the 58 cases with pulmonary lesions. This is doubtless a matter of considerable significance in the pathogenesis of intestinal tuberculosis, because in most cases with cavities tubercle bacilli reach the intestine regardless of how careful the patient may be in the disposal of sputum, since some may be swallowed during sleep. Miliary tubercles were present in the lungs in 17 cases, in the meninges in 1 case, and generalized miliary tuberculosis occurred 4 times. In 59 cases there was tuberculous pleuritis; the pleura being uninvolved in but a single case.

Among the 60 cases of intestinal tuberculosis ulcers were rare (1 or 2) in 10 cases, there were a few in 19, many were present in 18, and in 13 the ulcerations were very extensive. As to size, the ulcerated areas were minute in 7 cases, small in 25, large in 20, and very large (over 1 cm. in diameter) in 8 cases. The location of the

lesions is best shown in the following tabulation:

Ileum only	27
Cecum only	1
Colon only	2
Ileum, cecum and colon	14
Ileum and cecum	15
Cecum and colon	1
Total	60

Therefore, tuberculous disease of the intestine has as its site of preference the regions lying adjacent to the ileocecal valve with a greater predilection for the ileal side. This is in the zone of the greatest lymphoid tissue collections in the intestinal submucosa. Perforation of single ileal tuberculous ulcers occurred 4 times. Healed ulcers were present in but one case. This occurred in an 80-year-old Mexican woman with bilateral tuberculous pleurisy and tuberculous peritonitis, but without pulmonary disease. The healed ulcers were proven microscopically to be definitely tuberculous. This strongly suggests that, contrary to the expressions of some writers, there is but slight tendency to the spontaneous healing of the ulcers of intestinal tuberculosis. Not once did we encounter the calcified lesions of healed primary intestinal disease as recently reported by Ferris.[4] Tuberculous ulceration of the rectum occurred in two cases and fistula in ano was reported in a like number.

In the abdominal viscera, other than the intestines, miliary tubercles were found in the liver in 23 cases, in the spleen in 20, in the kidneys in 7, and chronic renal tuberculosis occurred 3 times. Tubercles were present on the peritoneum in 46 cases, on the visceral surface alone in 34, and both layers were involved in 12 cases. Thirty-two instances of enlargement of the mesenteric lymph nodes were observed, and in 23 cases there were also caseous changes in them.

TUBERCULOSIS IN OTHER ORGANS

The larynx was involved 7 times; in 5 there were ulcerations; 2 of these had miliary tubercles as well, and in 2 cases only miliary lesions were present. Generalized lymph node tuberculosis, tuberculosis of the tonsils, and tuberculous salpingitis each occurred once.

In 6 of the 60 cases pyopneumothorax was found, 3 with and 3 without bronchial fistulae. There was one instance of uncomplicated pneumothorax. Evidences of recent pulmonary hemorrhage were observed in 2 cases. One of the cases showed extensive amyloid changes in the liver, spleen and kidneys, while in another this change was present only in the spleen.

CLINICAL FINDINGS IN PROVEN INTESTINAL TUBERCULOSIS

The records of the same 60 cases of established intestinal tuberculosis were next examined to determine the relevant facts presented by the studies made on them during life. The chief complaints as stated by the patients were referred to the digestive tract in 18 cases, although 12 of these complained of pulmonary symptoms as well. In 30 cases the chief complaint was entirely referable to the respiratory system. The duration of intestinal symptoms as shown in the following table is noteworthy:

DURATION OF INTESTINAL SYMPTOMS

	Cases
3 years	1
1 year	1
8 months	1
5 months	1
3 months	5
2 months	2
1 month	4
Less than 1 month	3

It is probable from these figures that in only 3 or 4 of the cases were intestinal symptoms present prior to the terminal phase of the illness. That is a striking fact in itself, but it must be remembered that in 42 cases with proven intestinal tuberculosis no intestinal symptoms were noted at any time during life.

The symptoms and signs that were definitely gastro-intestinal were in the order of their frequency:

Symptoms	Cases
Anorexia	47
Abdominal pain	14
Vomiting	12
Diarrhea	12
Constipation	4
Melena	2
Physical Signs	
Abdominal tenderness on palpation	25
Gaseous distention	20
Fistula in ano	3

Omitting anorexia from consideration, since it is often present in uncomplicated pulmonary tuberculosis and because it is not necessarily an intestinal symptom, it is observed that less than half of the 60 proven cases of intestinal tuberculosis could, on the basis of history and physical examination, have been clinically suspected of having the enteric complication. Actually the

diagnosis of intestinal tuberculosis appeared as a clinical diagnosis on the charts of only 11 cases. Gastro-intestinal x-rays were done in only 2 cases and in neither was the diagnosis made by this means, despite the fact that the examinations were made 1 and 4 months before death.

In 1926 Brown and Sampson[5] emphasized that only by employing a special x-ray examination technic can the diagnosis of intestinal tuberculosis be made with any degree of proficiency. They contended that all patients with moderately or far advanced pulmonary tuberculosis to be considered adequately studied should be so examined. It is our intention to report in a subsequent communication the results of a systematic study by this method of a series of cases from the same hospital that supplied the autopsy material for this paper.

COMMENT

It is obvious that if any headway is to be made in the control of intestinal tuberculosis, early recognition of the condition must be established in those cases in which it is not a terminal event, so that treatment by ultraviolet irradiation or combined x-ray and ultraviolet ray therapy may be begun while it may still be effective. According to Brown and Sampson, this method, when used concurrently with the general treatment of tuberculosis, not only greatly ameliorates distressing symptoms, but is productive of healing in more than a fair number of cases. We cannot claim any semblance of accuracy in the diagnosis of intestinal tuberculosis by the routine measures commonly used. It is mandatory, therefore, that more adequate studies of the digestive tract be carried out in patients with pulmonary tuberculosis by x-ray as assiduously as we study the lungs by this method.

The significance of the development of intestinal tuberculosis in the patient with pulmonary tuberculosis cannot be overstated, as such an event may precipitate a critical status in the ingestion of food and consequently in the nutrition, and it augments greatly the toxemia from the infection. This naturally leads to a rapid deterioration of resistance and hastens death, which, in some instances, at least, might be averted.

SUMMARY AND CONCLUSIONS

In summarizing what has been said above, an effort has been made to learn the essential facts relative to the incidence and characteristics of intestinal tuberculosis in a general teaching hospital. The patients studied were worked up in accordance with the commonly accepted standards used in such cases. Inasmuch as information obtainable from a study of a series of cases with this disease seen only clinically is notoriously inaccurate, it was deemed imperative to accept only those in which the diagnosis had been established beyond reasonable doubt at autopsy. The important facts concerning intestinal tuberculosis as recorded in the autopsy protocols have been presented, together with the clinical evidences of the disease in the same group of patients. As a result it appears that the following conclusions may justifiably be drawn:

(1) Intestinal tuberculosis occurred in 21 per cent of patients with tuberculosis in all forms, and in 22 per cent of those with pulmonary tuberculosis.

(2) It was encountered more than twice as frequently in the Negro, and was approximately two and one-half times more common in the male sex.

(3) The great majority of the cases of intestinal tuberculosis developed in the course of chronic ulcerative pulmonary tuberculosis, and in considerably more than half of these it was a late event in an already hopeless disease.

(4) In a small percentage of cases it was present for longer periods, and may well have been the precipitating cause of death.

(5) The intestinal disease was always secondary, not a single case of primary tuberculous enteritis having been observed.

(6) Studied by the ordinary methods it was impossible to diagnose intestinal tuberculosis in more than one-sixth of the cases in which it occurred.

(7) Special types of investigation of patients with tuberculosis in all forms must be undertaken if the diagnosis is to be made with any degree of accuracy, and at a time when therapy may be expected to be beneficial.

BIBLIOGRAPHY

1. Beitzke, H.: Uber primare Intestinaltuberkulose nebst Bemerkungen uber die Infektionswege der Tuberkulose. Virchow's Arch. f. path. Anat. und Physiol., Beikeft, **194**:225, 1908.
2. Heller, A.: Kleine Beitrage zur Tuberkulose-Frage. Munchen med. Wchnschr., **49**:609, 1902.

3. Blalock, J. W. S.: A Study of Tuberculous Disease in Infancy and Childhood, with Particular Reference to the Primary Sites of Infection. Brit. Jour. Tuberc., **29**:69, 1935.
4. Ferris, H. W.: Calcified Lesions of Primary Tuberculosis in the Intestine in Adults. Amer. Rev. Tuberc., **35**:794, 1937.
5. Brown, L.; and Sampson, H. L.: Intestinal Tuberculosis: Its Importance, Diagnosis and Treatment, 2nd Ed. Philadelphia: Lea & Febiger 1930.

DISCUSSION (*Abstract*)

Dr. Paul H. Ringer, Asheville, N. C.—In discussing this paper, I naturally take the viewpoint of the chest man who from time to time has to deal with cases of intestinal tuberculosis. That intestinal tuberculosis is far more frequent than we formerly believed it to be is, I think, beyond question, to which may also be added the belief that unquestionably in many instances spontaneous cure takes place.

Dr. Stone has wisely stressed the fact that there is no pathognomonic sign or symptom of intestinal tuberculosis. Since the work of Brown and Sampson a great deal of attention has been given to the x-ray. The x-ray, however, can show the presence of an ulcerative enterocolitis only by revealing areas of spasticity and filling defects; it cannot possibly make a diagnosis of tuberculous enteritis. The most important factor in diagnosis consists in the presence of a persistent enteritis in a patient known to have pulmonary tuberculosis.

My experience has been parallel to Dr. Stone's in that I have never seen a primary intestinal tuberculosis, though, like him, I have read of such cases in foreign literature and have been surprised that in this country such findings could not be duplicated.

Treatment has proven, on the whole, more satisfactory in latter years than previously. This probably is due to its being instituted sooner, because the condition, if not actually proven, is kept more in mind and, as the late Dr. Lawrason Brown well said in his tuberculosis thesis, "One of the best ways of diagnosing tuberculosis is to bear the disease in mind." The methods most in vogue in the treatment of tuberculous enteritis are: the use of the quartz light, the use of calcium chloride or calcium gluconate intravenously, the high vitamin diet as typified by the administration of tomato juice and viosterol; and, when the pathological process can be definitely located, radical surgery, with resection of the diseased areas its object. Unfortunately, as yet there has developed no definite way of diagnosing small bowel tuberculosis.

Dr. Frederic M. Hanes, Durham, N. C.—Intestinal tuberculosis often is difficult to recognize clinically. It is the practice of Duke Hospital to treat all open tuberculosis prophylactically, as regards the intestinal tract, according to the recommendations of MacKonkie (*Amer. Review of Tuberculosis,* 21:627, 1930). This author has proven that a high-vitamin-high-caloric diet, with calcium, is very efficacious in protecting the gut from tuberculous infection.

Dr. V. C. Tucker, San Antonio, Tex.—Dr. Stone has presented a scientific study of the first class, but autopsy statistics may be misleading on the side of conservatism. The exceedingly low incidence of anal fistulae in this series might lead us to suppose fistulae are rare in tuberculous patients and then only in the late pulmonary cases. It is well known that anal fistula is a frequent finding in the tuberculous patient. Very few men now claim that every patient with a fistula has tuberculosis, but as Koerth and his co-workers in San Antonio pointed out some years ago, an anal fistula is often the most frequent primary indication leading to a diagnosis of pulmonary tuberculosis. The fistula often precedes the diagnosis of pulmonary tuberculosis by five years or more. In our charity proctology clinics in San Antonio (mostly Mexicans with a high incidence of tuberculosis) all fistula cases have a routine lung examination and Wassermann before admittance for operation. From 20 to 30 per cent of these fistula patients have an associated pulmonary tuberculosis. That does not mean the fistulae are all tuberculous nor do I know the per cent of fistulae in all cases coming to the chest clinic because of tuberculosis. It is true that the initial peri-anal abscess often occurs during an acute bronchitis of any origin. But to me, every case of anal fistula should have tuberculosis ruled out if possible before operation. Some of our lung men are even beginning to doubt the necessity of finding a lot of lung involvement in order to suspect a bowel lesion of being tuberculous and some of this doubt strangely is based entirely on autopsy findings in certain cases. Again I wish to emphasize that I am not trying to belittle Dr. Stone's scientific observations with purely clinical observations that at best are always untrustworthy.

Dr. Stone (closing)—It was not intended to convey the idea that treatment consisted of irradiation therapy alone, since it was distinctly stated that this type of treatment should be used concurrently with the general treatment of tuberculosis. Calcium, tomato juice, and general measures were used.

The primary purpose of this communication is to state proven facts as established at autopsy in a series of patients with tuberculosis because it is believed that any conclusions arrived at from a study of material other than that obtained at autopsy is entirely misleading and unreliable. The results of this study were accurately obtained and speak for themselves. It is realized that the incidence of intestinal tuberculosis in our series, just over 20 per cent, is in striking contrast with the figures of 50 to 80 per cent usually given as the incidence of the intestinal complication. We ourselves were quite surprised to learn of this sharp difference, the answer to which is not altogether clear. However, I believe that to a considerable extent it is due to the fact that we employ in our service a higher percentage of collapse therapy in the treatment of pulmonary tuberculosis than is used in most institutions. The closing of active tuberculous lesions in the lungs by these procedures results in a lessening of the possibility of intestinal infection with tubercle bacilli.

Perhaps the most important lesson that we may learn from the investigation reported is that we are lacking in accurate diagnostic criteria in intestinal tuberculosis, and that we may do better by subjecting tubercular patients in general to a more thorough study for the lesions of the intestinal disease.

THE TREATMENT OF HYPOPARATHYROIDISM WITH DIHYDROTACHYSTEROL*

By CYRIL M. MACBRYDE, M.D.
St. Louis, Missouri

The treatment of chronic tetany has in general been unsatisfactory. This is true chiefly because of two factors: first, patients with chronic tetany may fail to exhibit the classical signs expected in the disease and may go undiagnosed for months or years; second, the therapeutic means at our command have been inadequate. Carpopedal spasm and severe muscular cramps may never occur. Chvostek and Trousseau signs may be absent. Although it may be known that the blood calcium is low, physicians often tend to minimize the patient's complaints if obvious muscular spasms do not occur. Neuromuscular hyperexcitability is the most striking of the manifestations exhibited by patients with chronic tetany, but other symptoms are no less disturbing. When muscular cramping, carpopedal spasm, or convulsions occur spontaneously the tetany is said to be manifest.

Tetany is generally looked upon as an uncommon or rare malady. As many as eighty-eight cases, however, have been reported from one institution during a six-year period.[1] Modern surgery has reduced the incidence of tetany following operations upon the thyroid gland to very low figures variously estimated as ranging from 1.5 to 0.5 per cent.[2] The actual number of cases of tetany is nevertheless becoming larger because of the increasing frequency of operations upon the thyroid and parathyroid glands. The symptoms of tetany may appear within a few hours or a few days following the operation because of removal of or injury to the parathyroid glands or their bood supply. Frequently these symptoms are only temporary and subside in a few days. The blood calcium may remain low only a few days or a few weeks and the patient may completely recover. In many patients, however, the damage to the parathyroids is permanent, and although the patient may recover from the acute symptoms, he may suffer indefinitely from chronic hypocalcemia with less obvious manifestations.

*Read in Section on Medicine, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

*From the Department of Medicine, Washington University, and the Barnes Hospital, St. Louis, Missouri.

Every case of manifest tetany not ending in death passes, after a variable length of time, into a latent state. The neuromuscular symptoms may then appear only during pregnancy, lactation or menstruation or as a result of infection, trauma, or psychic disturbance. The disabilities of the patient with chronic hypocalcemic tetany are not confined to the neuromuscular system. Other symptoms may be less obvious than the typical carpopedal spasm and muscular cramps, but may be much more disabling.

SYMPTOMS OF CHRONIC TETANY

In chronic tetany the nutritional state is apt to be poor and general weakness and easy fatigue are evident. Psychological changes, usually restlessness, irritability, and depression may be present and true psychoses have been described. Headache, sometimes migrainous in type, is frequent. Epileptiform convulsions may occur or the attacks may resemble petit mal. Paresthesiae of various types and fleeting aches and pains are common. Special sense disturbances with various abnormalities in taste, smell, sight, or hearing are not infrequent.

There is often vasomotor disturbance, pallor, coldness of hands and feet, and sweating. Anginoid precordial pains are not uncommon. There is often a tachycardia otherwise unaccounted for. In some patients there seems to be a true association with angioneurotic edema.

Gastro-intestinal symptoms may consist of nausea, belching, vomiting, diarrhea or spastic constipation and severe intestinal cramps. Fluoroscopic examination at such times may reveal true spasm of the intestine. Bladder tenesmus and urinary frequency are not uncommon.

The formation of lenticular opacities is characteristic of prolonged chronic tetany and may be the first sign to indicate that the patient has had hypocalcemia for years. Bilateral cataracts have been reported in 50 per cent or more in some series.[3] Loss or graying of the hair and ridging of the teeth and nails are frequent, though less serious, ectodermal changes. The most urgent reason for diagnosing chronic tetany is that by proper treatment we may prevent the formation of cataracts which are usually bilateral, progressive, and may lead to complete or nearly complete blindness.

DIAGNOSIS

The diagnosis of tetany in the latent state

may be made by (1) demonstration of mechanical hyperirritability by eliciting Chvostek's or Trousseau's signs. Even when the blood calcium is very low one or both of these signs may, however, be absent. (2) Demonstration of electrical hyperirritability by galvanic current when applied over the median or ulnar nerves gives a value for the cathodal opening contraction under 5 milliamperes. (3) Blood chemical changes. The blood calcium is low and the blood phosphorus tends to be elevated. There is no definite parallelism between the severity of the tetany and the degree of depression of the serum calcium. In manifest tetany the blood calcium is usually 7 or below and in latent tetany it may be 8 or higher. However, patients may be seen with serum calcium of 5.5 or 6.0 mg. per cent in whom no characteristic history is obtainable and in whom no Chvostek or Trousseau signs can be elicited. Other patients may continue to exhibit these signs, even after the blood calcium has been elevated to normal. I am not aware whether this has previously been observed, but in one of our cases a positive Chvostek sign was obtained even after the blood calcium had been elevated to hypercalcemic levels. Thus it seems important to keep in mind that the signs of Chvostek and Trousseau are helpful but cannot be depended upon to give us an idea of the actual level of the blood calcium. When using a potent therapeutic agent hypercalcemia must be guarded against and the disappearance of the Chvostek sign will not always occur as the blood calcium reaches normal.

Electrocardiographic changes may occur. They usually consist of prolongation of the ST interval and flattening of the T waves. The cataracts of tetany have a characteristic form and experts may determine the earliest changes by means of the slit-lamp.

TREATMENT

Patients with chronic and latent tetany frequently receive comparatively little therapeutic attention because of the absence of symptoms such as characterize the more dramatic acute cases. The various methods of treatment which have been available up until recently were comparatively ineffective in relieving the symptoms of chronic tetany. The intravenous use of calcium salts and the subcutaneous or intramuscular injection of parathyroid hormone is very effective in relieving the muscular cramps or convulsive seizures of acute tetany. The blood calcium is, however, only temporarily restored to normal by these measures. The injection of calcium salts or parathyroid hormone must be repeated at least every twenty-four hours to maintain calcemia at anywhere near a normal level. After prolonged use of parathyroid extract a tolerance is developed so that increasingly large doses are necessary and finally little or no effect is obtained. This observation, pointing to the ineffectiveness of parathyroid extract in the treatment of chronic tetany, is illustrated in several of the case reports which follow.

Up until one year ago we employed the usual treatment in our chronic cases: large doses of calcium salts by mouth combined with hydrochloric acid or ammonium chloride and with cod liver oil or viosterol in large doses. In addition we have used low phosphorus diets as advocated by Shelling.[4] We have found that each of these therapeutic measures has been of some value and has helped in the elevation of the blood calcium and in the relief of symptoms. We have, however, been unable to bring the blood calcium up to normal levels with these measures in cases with severe chronic tetany. The blood calcium has been elevated from values around 5.5 and 6.0 mg. per cent to 7.0, 7.5, or even 8.0 mg. per cent in some cases. Accompanying the failure to establish normal blood calcium has been the occurrence of the typical symptoms of chronic tetany with anorexia, weakness, easy fatigue, headache, and paresthesiae, among the prominent complaints. Frequently these symptoms have been so troublesome as to prevent the patient from engaging in a gainful occupation. The neuromuscular features have usually been latent, but cramping and carpopedal spasm have appeared from time to time.

We have had some experience with parathyroid transplants. We have been unable to confirm the good results observed by others, even when the transplant is performed by growing the tissue in the recipient's serum as has been advocated.[5] Two of our patients had parathyroid transplants so prepared and showed no improvement. The procedure was repeated four times at intervals of some months in one of these cases and no definite results were observed. One of our patients received a transplant of a parathyroid gland obtained from her mother and had a period of temporary improvement with some relief of her symptoms, but the blood calcium shortly returned to its previous low level. Calcium salts, in the form of the gluconate and the lactate chiefly, have been given in doses of as

much as 25 grams per day, but our patients have complained not only of loss of appetite, but of nausea and abdominal distress from this medication as well as from hydrochloric acid or acid salts.

Viosterol has been given in fairly large amounts. Maintenance doses of from 1 to 4 c. c. daily have not produced or maintained normal blood calcium levels. Viosterol does elevate the blood calcium. When, however, the blood calcium is as low as 6 or 7 mg. per cent very large doses of viosterol are necessary to restore the blood calcium to normal and with these large doses toxic effects are experienced so that it is not practicable to continue the treatment.

Despite our best therapeutic efforts previous to the introduction of dihydrotachysterol, two of the patients I am here reporting have developed cataracts and one has suffered from severe epileptiform convulsions.

INTRODUCTION OF DIHYDROTACHYSTEROL

Holtz,[6] working with Windaus in Gottingen, studied the effects of the various fractions of irradiated ergosterol upon calcium metabolism. Among these it was found that three sterols caused definite elevation of the blood calcium. These were the fractions known as tachysterol, toxisterol, and the one believed to be vitamin D itself. The vitamin D fraction alone exhibited antirachitic properties. When tested on mice, toxisterol was found to be three times as toxic as vitamin D, while tachysterol was only one-third as toxic. Tachysterol, therefore, because of its low toxicity, was selected for further study of its calcium-elevating effects. It was thought probable that the toxic effects previously seen with viosterol were caused by toxisterol and by some of the other sterols, such as lumisterol and suprasterol I and II which have little or no effect upon calcium metabolism. A dihydro derivative of tachysterol was found to be still less toxic and to have a very marked effect upon the blood calcium. With small doses of dihydrotachysterol by mouth it was possible to relieve tetany in parathyroidectomized animals and to maintain the blood calcium at normal levels. Holtz introduced the preparation into use for the treatment of tetany and found it effective in cases following thyroid operations and in idiopathic cases as well. It was introduced under the name of "A.T.10" (anti-tetany preparation No. 10). A number of patients have been treated, chiefly in Germany, with very satisfactory results. Very few cases have as yet been treated with dihydrotachysterol in the United States. Arnold and Blum[7] and Swinton[8] have, however, reported observations which confirm the good results obtained in Germany. The preparation is not as yet manufactured in the United States.

Four patients with chronic parathyroid tetany following thyroidectomy successfully relieved with dihydrotachysterol are here reported.* All of these were white women who have been under our observation and treatment for some years. The dihydrotachysterol was given orally in the form of a solution in sesame oil containing 5 mg. per c. c.†

CASE REPORTS

Case 1.—A woman, aged 43, had a subtotal thyroidectomy for thyrotoxicosis in 1907; recurrence and second operation in 1927. Five days following this operation numbness and muscle spasm began. Bilateral cataracts developed in the course of the next four years. Parathyroid transplants, 1931 (tissue obtained from patient's mother) were tried without result. Parathyroid extract was given daily until tolerance developed. With 6 grams of calcium lactate and 20 drops of viosterol twice daily, the blood calcium ranged from 5.5 to 8.1 mg. per cent. The viosterol was omitted and 10 grams daily of calcium lactate was given for two weeks. The blood calcium ranged from 5.6 to 6.5 and the blood phosphorus from 4.7 to 6.2. One-third c. c. of "A.T.10" was given three times daily and the calcium intake was not changed. There was no change in the blood calcium until the sixth day, when it was 7.0. On the eighth day it was 7.4, on the tenth day 8.3, on the fourteenth day 10.1. At this point the dose was reduced to one-third c. c. once daily. On the twenty-second day the calcium was 10.6. It gradually fell somewhat, but has remained between 8.5 and 10.2 during the seven months since the therapy was started, the calcium lactate intake being kept at 10 grams daily and the "A.T.10" dose at one-third c. c. daily. The blood phosphorus has fallen somewhat, ranging from 3.6 to 5.0 mg. per cent. There are no signs or symptoms of tetany.

Case 2.—A patient of 35 had had subtotal thyroidectomy for typical Graves' disease in 1926. There was recurrence of symptoms and a second operation was done in 1927. After another recurrence, x-ray therapy was administered in 1933, and a third operation for recurrence was done in 1933. Within 24 hours symptoms of severe tetany appeared. Calcium gluconate, 12 grams daily, and 3 c. c. of viosterol daily failed to control the symptoms. Parathyroid extract was given and completely relieved the symptoms when daily injections were given, but tolerance developed and the hormone was no longer effective. Despite doses of 2 to 4 c. c. daily, the blood calcium remained around 6 mg. per cent and there were severe muscle spasms. Parathyroid transplants were tried four times: in December, 1933, in April and August, 1934, and in March, 1936, without notable results.

Symptoms of tetany persisted when the patient took

*Since this report was prepared, 4 more cases, one of them idiopathic and subject to severe epileptiform convulsions, have been treated with equally satisfactory results.

†The dihydrotachysterol (A.T.10) was supplied through the courtesy and generosity of the Department of Medical Research of the Winthrop Chemical Company.

20 grams of calcium gluconate, 3 c. c. of viosterol, and from 4 to 6 c. c. daily of dilute hydrochloric acid, and the blood calcium was 7.0 mg. per cent, the blood phosphorus 4.7 mg. per cent. When "A.T.10," 0.5 c. c. daily, was given the blood calcium rose to 8.9 in four days and the calcium intake was promptly reduced to 3 grams daily. The blood calcium rose further and with 0.5 c. c. of "A.T.10" and 3 grams of calcium gluconate ranged from 10.0 to 10.2 mg. per cent. When the "A.T.10" dose was reduced to one-fourth c. c. daily, the blood calcium fell slowly over a period of nine days to 8.2 mg. per cent. An increase of only 2 grams daily in the calcium intake to 5 grams daily resulted in a serum calcium rise to 10.2 mg. per cent. Since that time, during a period of over one year, the blood calcium has been kept at 8.5 to 10.2 mg. per cent with one-fourth c. c. "A.T.10" daily and 5 grams of calcium gluconate, and all symptoms have been relieved.

Case 3.—A patient, 46, had had subtotal thyroidectomy for thyrotoxicosis in April, 1934. Symptoms of tetany developed gradually. Two months postoperatively definite cramps and paresthesiae occurred. Therapy consisted of calcium lactate, 10 grams daily, and viosterol, from 1 to 3 c. c daily. Acute episodes occurred from time to time controlled with 100 units of parathyroid extract once or twice daily. Immediately preceding this study with 4 grams of calcium gluconate and 2 tablespoonfuls of cod liver oil daily, her serum calcium was 7.5, phosphorus 4.8 mg. per cent. The cod liver oil was stopped, the calcium intake was unchanged, and one-fourth c. c. daily of "A.T.10" was given. In seven days the calcium was 8.3. In fourteen days the calcium was 8.8, the phosphorus 4.3 mg. per cent. When "A.T.10" and calcium were omitted for 21 days the calcium fell to 7.7 mg. per cent. Even if no calcium were added to that in the diet, the blood calcium could be maintained at 8.6 mg. per cent with 0.5 c. c. daily of "A.T.10." With 1.0 c. c. daily it rose to 10.0, with 1.3 c. c. daily to 10.2, when only 2 grams of calcium were allowed with 1.3 c. c. of "A.T.10" daily, the serum calcium rose to 11.0 mg. per cent. The calcium level has since been maintained for a period of over six months at 9.3 to 9.9 mg. per cent with 4 grams of calcium gluconate and one-third c. c. of "A.T.10" per day, and the patient has been free of symptoms.

Case 4.—A patient, aged 56, had had thyroidectomy for thyrotoxicosis in 1920. Three weeks postoperatively cramps in the hands began. Tetany of varied severity ensued for ten years and bilateral cataracts developed. In 1930 she began to have severe generalized epileptiform convulsions. These have occurred at irregular intervals, especially when the blood calcium was unusually low. Just before this study there were as many as four or five convulsions daily, although her blood calcium was relatively high, 7.5 mg. per cent. The phosphorus was 5.8 mg. per cent. She was admitted to the hospital unconscious following a convulsive seizure witnessed in the out-patient department. With "A.T.10," 1.0 c. c. daily, no calcium being added to the diet, the blood calcium gradually rose to 9.8 mg. per cent during a period of two weeks. From the day over six months ago when the "A.T.10" was started, there have been no further convulsions. All symptoms of tetany have been relieved, and the blood calcium ranges from 9.2 to 10.2 mg. per cent, phosphorus 4.9 to 5.3 mg. per cent with 6 grams of calcium gluconate and 0.6 c. c. of "A.T.10" daily.

DISCUSSION

Four women suffering with chronic hypoparathyroidism following thyroidectomy were completely relieved by treatment with dihydrotachysterol. The previous duration of the symptoms of tetany ranged from three and one-half to seventeen years and all previous therapy had been comparatively ineffective. Temporary relief only had been afforded by parathyroid extract and intravenous calcium injections. Two patients had developed resistance to parathyroid hormone and failed to show any definite response to it. Two of these patients had developed bilateral cataracts previous to the "A.T.10" therapy. One patient had suffered frequent severe epileptiform convulsions. The convulsions did not recur after treatment with "A.T.10," although they had occurred at intervals for years and she was suffering with as many as four or five attacks a day immediately preceding the institution of treatment with dihydrotachysterol. Approximately normal serum calcium levels are now being maintained in all of these patients with doses of one-third to 1 c. c. daily supplemented by calcium lactate or gluconate, 4 to 10 grams daily. At the time this is written, one patient has been free of symptoms for over one year, one for seven months, and two for over six months. We have not observed any evidence that a tolerance has been developed to the drug. In some of the cases smaller doses than those originally used are now sufficient to keep the blood calcium within normal limits. In no case has it been necessary materially to increase the dose. Dihydrotachysterol alone will raise the serum calcium to normal. It is necessary, however, to use larger doses of the sterol if no calcium is added to that contained in the usual diet. Daily doses of 1 to 2 c. c. with an average normal diet will produce approximately normal blood calcium, but much smaller doses of the sterol can be used if calcium salts are also taken. This is an important consideration because it greatly reduces the expense of the treatment and it is much cheaper for the patient to use smaller doses of the "A.T.10" and from 4 to 10 grams of calcium lactate or gluconate daily. We have found calcium lactate, 2.5 grams in the form of the powder thoroughly stirred in water or milk and taken with or just after meals, to be a successful and not unpleasant adjuvant of "A.T.10."

It is interesting to compare the effects of dihydrotachysterol with those of parathyroid extract. The rise in the blood calcium in all cases was as definite as that obtained with the parathyroid

hormone. The time intervals, however, for the appearance of the response are quite different. The rise with the hormone appears in a few hours, reaches a maximum in from 3 to 8 hours, and the effect is usually entirely lost within 24 to 48 hours. With "A.T.10" the first increase appears in about 48 hours. When small doses are given the rise continues until in from 7 to 14 days normal calcium levels are achieved. When larger doses are given, such as those originally advocated by Holtz, the blood calcium rises quite rapidly and may reach normal in 4 or 5 days. Holtz originally recommended 10 c. c. the first day, then 5 c. c. daily for several days, then 2 c. c. or less daily as the blood calcium approached normal. I believe that in most cases it is unnecessary and even inadvisable to try to produce a return to normal calcemia with "A.T.10" in less than a week. There is, with larger doses, a great danger of producing hypercalcemia with severe toxic effects. In most cases the low blood calcium has been present for a long time and there is no necessity for great haste. When the patient is suffering with acute symptoms of tetany, "A.T.10" is not the treatment of choice because of its relatively slow action. For the patient having severe cramps or convulsive attacks the intravenous injection of calcium salts produces dramatic and immediate relief. Parathyroid extract and intravenous calcium injections may be used to relieve acute symptoms and tide the patient over the first few days until the "A.T.10" therapy has had a chance to exert its effect. A good plan of dosage for the average case for a blood calcium between 6 and 7 mg. per cent would probably be 2 c. c. twice daily the first day, 2 c. c. once daily for several days with reduction of the dose to 1 c. c. or 0.5 c. c. daily as the blood calcium approaches normal. Once a normal level is reached it is possible to reduce the dose to between 0.5 c. c. three times weekly to 1 c. c. daily. The maintenance dose varies considerably among individual patients. The total dose necessary to establish normal blood calcium in the beginning of treatment also varies greatly between cases. Blood calcium determinations are necessary at least every 48 hours until a constant normal calcium level is achieved.

The blood phosphorus in the first stages of treatment shows as a rule a slight initial rise, then a slow fall as the calcium approaches normal. When "A.T.10" therapy is discontinued the blood calcium falls slowly over a period of one to three weeks until the previous level is reached.

Advantages.—Dihydrotachysterol is preferable to parathyroid extract in the treatment of chronic tetany. This preparation can be taken orally in small doses and the patient can thus avoid the frequent intramuscular or subcutaneous injections necessary with the hormone. No tolerance is developed to "A.T.10," whereas the effect of parathyroid extract is a gradually diminishing one in many cases, and finally complete resistance is often developed. "A.T.10" has a much more prolonged action, as is desirable in the treatment of a chronic condition. When computed by the results obtained over a considerable length of time, treatment with dihydrotachysterol is less expensive than treatment with parathyroid extracts. An additional factor of no small importance is that the sterol is stable and retains its potency when kept at ordinary room temperature.

It is as yet uncertain just how this sterol produces its effect upon the calcium metabolism. We are conducting calcium and phosphorus balance experiments in an effort to ascertain whether a positive or negative balance is produced by therapeutic doses in human beings. It is important to determine whether the increase in blood calcium has as its source the gastro-intestinal tract or the bones. It may be that the effect will be similar to that previously seen with viosterol, which of course contains a number of other sterols in addition to this one. That is, small doses may produce a positive calcium balance and large doses may produce a negative balance and metastatic calcification.

A warning against the indiscriminate or careless use of this very potent preparation is imperative. Excessive doses of the drug cause very severe toxic effects associated with marked hypercalcemia. There is great individual variation in the response to the drug. Only small amounts are necessary and until maintenance dosage is established frequent determinations of the blood calcium must be made.

CONCLUSIONS

(1) Hypocalcemic tetany can be successfully treated with small doses of dihydrotachysterol taken orally. The symptoms can be entirely relieved and the blood calcium can be maintained at normal levels.

(2) Larger doses are required if no calcium is given in addition to that normally contained

in the diet. It seems advisable to use small doses of calcium salts in divided doses as adjuvant therapy.

(3) Small doses of calcium salts by mouth cause remarkable and prompt rise in blood calcium in patients receiving dihydrotachysterol.

(4) The methods of choice for the treatment of acute tetany are the intravenous injection of calcium salts and the intramuscular injection of parathyroid extracts.

(5) For the treatment of chronic tetany dihydrotachysterol has many advantages over parathyroid extract and all the other means of treatment we have previously used.

REFERENCES

1. Boothby, W. M.; Haines, S. F.; and Pemberton, J. de J.: Postoperative Parathyroid Insufficiency. Amer. Jour. Med. Sci., **181**:81-96 (Jan.) 1931.
2. Swinton, N. W.; and Claiborne, T. S.: Postoperative Parathyroid Tetany. S. Clin. North America, **16**:1601-1611 (Dec.) 1936
3. Holtz, F.; Gissel, H.; and Rossman, E.: Experimentelle und klinische Studied zur Behandlung der postoperativen Tetanie mit A.T.10. Deutsche Ztschr. f. Chir., **242**:521-569 (Mch.) 1934.
4. Shelling, D. H.; and Goodman, M. J.: Calcium and Phosphorus Studies: Importance of Low Dietary Phosphorus in Treatment of Parathyroid Tetany. J.A.M.A., **102**:669-673 (March 3) 1934.
5. Stone, H. B.; Owings, J. C.; and Gey, G. O.: Living Grafts of Thyroid and Parathyroid Glands. Surg., Gynec. & Obst., **60**:390-393 (Feb.) 1935.
6. Holtz, F.: Bericht uber Erfahrungen mit A.T.10. Klin. Wchnschr., **13**:104-108 (Jan.) 1934.
   Holtz, F.: Die Tetanie (Nebenschilddruseninsuffizienz) und ihre Behandlung. Med. Klin., **32**:656-660 (May) 1936.
7. Arnold, C. H.; and Blum, H.: Control of Hypoparathyroidism. West. Jour. Surg., Obst. & Gynec., **44**:546-555 (Sept.) 1936.
8. Swinton, N. W.: Postoperative Parathyroid Tetany. New Eng. Jour. Med., **217**:165-169 (July 29) 1937.

DISCUSSION (*Abstract*)

Dr. Frederic M. Hanes, Durham, N. C.—The ever-fascinating story of the vitamins and hormones has reached the chapter dealing with their exact chemical constitution. One by one they are being reduced to chemical formulae and furnished in crystalline form to the therapeutist. To complete the story, we must find out precisely where and how these powerful chemical substances act. Within the past few weeks Drs. D. T. Smith and Julian Ruffin, at Duke Hospital, have successfully treated a severe pellagrin with nothing but nicotinic acid, following the suggestion of Elvehjem. It is possible that this relatively simple substance is the long-sought pellagra preventive factor of Goldberger.

The present essayist has added most welcome information which sheds light on the calcium-controlling action of the vitamin D complex. When ergosterol, a sterol abundantly present in the skin, is irradiated with ultraviolet light it passes through a series of transformations, the most important of which is the crystalline product calciferol, which is called vitamin D. However, studies of different derivatives of cholesterol and calciferol have shown the existence of at least six forms of vitamin D, in addition to two other forms occurring naturally in fish liver oils.

We have just heard how a derivative of one of these fractions of irradiated ergosterol, namely dihydrotachysterol, seems to possess to a high degree the power of raising the blood calcium level, and thus aids greatly the treatment of hypoparathyroidism. Collip himself early pointed out that his parathormone lost its calcium mobilizing powers after being injected over a matter of weeks or months. In dihydrotachysterol we may have a substitute for parathormone.

Dr. Samuel S. Riven, Nashville, Tenn.—The biochemistry and pharmacology of this drug are known. Dihydrotachysterol is a reduction product of tachysterol, the isomer of ergosterol, which precedes vitamin D in the series of ergosterol irradiation products. It is said to be the active component of the commercial solution called "A.T.10," which is made in Germany and distributed in this country. It is not a form of vitamin D, since it is not antirachitic, but it has one of the properties of vitamin D (shared also by parathormone) of raising the blood calcium level. In other words, parathyroid tetany can be treated by either parathormone, vitamin D, or dihydrotachysterol, but rickets responds only to vitamin D. All three substances raise blood calcium, but only vitamin D causes it to be deposited in the bones. As a matter of fact, vitamin D promotes calcification of the bones only at moderate levels of administration; at very high doses this action may be reversed under certain conditions. As a sterol, dihydrotachysterol is related to all the other sterols, including cholesterol, ergosterol, and vitamin D, and also to the sex hormones, cardiac poisons, and venoms.

This paper is a practical one and I am sure it will stimulate interest in the treatment of hypoparathyroidism. Dihydrotachysterol seems to be a valuable addition to parathormone and the various forms of calcium taken by mouth or intravenously which have already been used. It is well to note that parathormone loses its effect after repeated administration.

I understand that Dr. MacBryde is adding additional cases to his series. I and others will undoubtedly try it in combating the symptoms of tetany. From the author's experience and that of others will come the final evaluation of the use of dihydrotachysterol in particular and in the treatment of hypoparathyroidism in general.

Dr. MacBryde (closing).—The results obtained with nicotinic acid in the treatment of pellagra when compared with those known to occur with various types of vitamin B therapy are indeed comparable to the results obtained with dihydrotachysterol and vitamin D in hypocalcemia. Whether "A.T.10" shall be considered a fraction or type of vitamin D must depend upon future investigation. If we define vitamin D as a substance relieving or preventing rickets, "A.T.10" would apparently be excluded from the vitamin classification. As far as we know the results of "A.T.10" therapy persist only so long as the treatment is continued.

OPERATIVE TREATMENT OF INGUINAL HERNIA*

REPORT OF ONE THOUSAND AND FORTY-EIGHT CASES

By EDWARD T. WEST, M.D.
LEE K. GIBSON, M.D.
and
HORACE B. CUPP, M.D.
Johnson City, Tennessee

It is the purpose of this paper to present a fairly accurate follow-up of one thousand and forty-eight inguinal hernias operated upon in the period from January, 1928, to June, 1937. These repairs were all performed on adult male patients, the youngest patient being 18 years of age and the oldest 87. The greater percentage were in the fourth decade of life. Only adult male patients are reported, children and females being omitted from this series which includes both private and institutional cases. The repairs were all performed by one or the other of the authors, and a large number of these patients have been constantly followed and examined on one or more occasions. Letters were accepted in a small percentage of the cases. We are now able to report the end results in more than 80 per cent of the total number.

All of these cases were inguinal hernia; 401 right indirect, 380 left indirect, 73 right direct, and 87 left direct; the remainder were bilateral. In the latter type the numbers of indirect and direct were about equal. Strangulation has been very infrequent in our series, there being only 5, none of which has had a recurrence after four years.

The indirect hernia predominates over the direct in a ratio greater than 4 to 1.

In this group of cases, as will be seen in *Table 1*, in 828 traced herniotomies there were 60 recurrences, or 7.24 per cent. It will be noted in this table that the recurrence rate in left inguinal hernia is greater than on the right side.

As will be seen in *Table 2*, there are 678 traced indirect herniotomies with a recurrence rate of 5.72 per cent, while the recurrence percentage in the direct hernia is 14.66 per cent. (As is noted in this diagram, we show an improvement in our recurrence rate since the 1933 period.)

Every hernia is an individual problem. Failure in the classical inguinal herniorrhaphy has been ascribed to: suture of the conjoined tendon and inguinal ligament under tension; the suture of heterogeneous tissues; the use of foreign suture material; the unsatisfactory treatment of the sac, and failure to close the canal snugly around the cord at the internal ring. To this should be added improper wound healing from infection.

A large percentage of recurrences are reputed to develop at the pubic end of the cord. To overcome this possibility our first suture is placed through the periosteal fascial coverings of the pubic spine, conjoined tendon and inguinal ligaments at that angle. Chromic catgut was employed in practically all of these cases, and is, we consider, preferable to fascia grafts. Silk was employed in a comparatively small number of cases.

The method of choice in closing the sac has been in the indirect hernia, after the sac has been carefully and thoroughly freed at the internal inguinal ring, to transfix and ligate it. If this is accomplished, the stump will drop back freely, or, as Watson[2] describes it, as with a good spring back within the internal inguinal ring. In a number of cases the sac was twisted and transfixed, fastened up under the internal oblique muscle by the stump ligature; this method made no appreciable change in the recurrence rate. The small direct sac is not opened. At this point we wish to emphasize that a small direct hernia is the occasion frequently of an unnecessary operation. The large direct sac that is opened is closed by continuous suture. In this type of case, as would be expected, the recurrence rate is higher. When the repair of a direct hernia is being done an indirect hernia should be looked for, as the failure to do this may cost the surgeon a recurrence. The former type of hernia has no connection with the internal and external inguinal ring, but arises from a weak posterior inguinal canal wall. In repair, this should be adequately reinforced. Careful review of the literature fails to reveal any good description of an operation uniformly used in dealing with this type of hernia.[3] The rectus muscle and fascia are frequently used in our repair of this defect. Winslow first described this operation. We reinforce this additionally by embrocation of the fascia of the external oblique underneath the cord; this latter is always done in repair of large indirect hernias as well. Dr. Woolsey[4] recently described this operation before the Southern Surgical Association.

In the case of bilateral primary inguinal hernia we recommend the repair of the larger hernia

*Read in Section on Surgery, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

Table 1

ANATOMICAL CLASSIFICATION

Types	Indirect		Direct		Bilateral		Total
	Right	Left	Right	Left	Direct	Indirect	
Total number done January, 1928, to June, 1937	401	380	73	87	50	57	1048
Total number traced	331	308	53	50	41	45	828
Number of recurrences traced	13	15	4	5	11	12	60
Percentage of recurrences traced	3.92	4.87	7.54	10	26.82	27.9	7.24

Table 2

TOTAL NUMBER OF TRACED HERNIOTOMIES WITH PERCENTAGE OF RECURRENCE

Date	Indirect		Direct	
	Traced	Recurred	Traced	Recurred
1928	57	5	11	3
1929	49	5	12	4
1930	59	6	11	5
1931	71	3	16	1
1932	73	5	11	1
1933	69	5	18	3
1934	70	4	21	1
1935	79	3	21	2
1936	104	2	21	2
1937	47	1	8	0
Total	678	39	150	22
Percentage		5.72		14.66

Table 3

BILATERAL OPERATIONS

Type	Traced	Recurrences	Percentage
Indirect	8	2	25%
Direct	12	4	33.33%

first. As shown in *Table 3*, the percentage of recurrence on one side or the other in bilateral hernia repaired at one operation is too frequent to justify this procedure. The high percentage of recurrences following this procedure may be due to a number of factors, such as:[5] the increased possibility of infection from large exposure of the operative field and the use of the same instruments on both sides; also there is an increased tension on the suture material in the bilateral operation. This is especially true if the patient develops any marked postoperative distention; also errors in technic may develop due to the surgeon's haste. The greater percentage of these hernias is direct. Some of the cases in this series were cases of arrested tuberculosis, or debilitated individuals with chronic coughs. This fact is not mentioned to condone any failures; however, we believe that a chronic debilitated condition associated with a cough is one of the factors producing recurrence in patients of this age, and we deplore any elective surgery in this type of case.

Scrotal hernia was noted in 104 of the patients and all were indirect. A large scrotal hernia stretches the muscles of the inguinal region to a thin atrophic state and makes the repair more difficult. These patients are placed in bed for a period of a week to ten days and the hernia is kept reduced if possible. In obese patients an effort is made to reduce the weight prior to operation. This type of case is technically more difficult to operate upon and the risk of infection is greater.

As might be expected, the highest recurrence rate occurred in those cases that were operated upon for recurrence, as is shown in *Table 4*. Here the material with which the repair was to be accomplished was often defective, entirely lacking, or atrophic, usually with faulty cleavage.

Practically all the cases in this series were operated upon under spinal anesthesia, as we feel that this type of anesthetic is preferable, due to the perfect relaxation and consequent lessened trauma to soft tissue.

Table 4

RECURRENCE IN PRIMARY AND RECURRENT HERNIAS

Type	No. of Hernia	No. Traced	Recurrence	Percentage
Primary	977	773	38	4.91
Recurrent	71	55	22	40

COMPLICATIONS FOLLOWING OPERATION

There were 22 wound infections in this traced series, of which 14 recurred, or a recurrence rate of 65 per cent. Every precaution is taken to avoid infection, including the removal of loose fat from the deep suture line.

In this series of cases there were two deaths, one from pulmonary embolus 17 days postoperatively; and a case of ileus died five days postoperatively. This latter was an unsatisfactory diagnosis and there was no autopsy permitted. Several patients complained of swelling of the testicle for from one to four months following operation; this was followed by a diminution of the swelling, going to normal and even atrophy. Sensitive scar was complained of in 21 cases, yet at all times scrupulous care was exercised to avoid injury to the nerves of the inguinal region.

We have had no experience with the injection treatment, we have examined no patient who has had this form of therapy, and none of the patients requested it.

Table 5

EFFECT OF AGE, DURATION OF HERNIA AND WEARING OF TRUSS ON RECURRENCE RATE

Date	No. Traced Using a Truss Prior to Operation		Average Duration in 828 Traced Hernia	Average Age of Patient
	Traced	Recurred		
1928	22	1	12 mos.	33
1929	23	1	3 yrs.	31
1930	21	2	5 yrs.	37
1931	41	0	18 mos.	39
1932	18	0	11 mos.	39
1933	10	1	4 mos.	27*
1934	32	0	18 mos.	30*
1935	8	0	2 yrs.	41
1936	7	1	21 mos.	42
1937	17	0	27 mos.	47
Total	199	6	Av. 2 yrs.	Av. 36½ yrs.

*CCC boys.

The time interval of the duration of the hernia had no appreciable effect on the recurrence rate as will be seen by comparing *Tables 2* and *5*. As is noted in this series, prior to operation, 199 of the hernias were retained by a truss and of the 60 recurrences only 6 had worn a truss. Thus we do not feel that the wearing of a truss affects the recurrence rate.

These patients were not interrogated in regard to the role of trauma in producing the hernia.

Following operation the patient is placed in bed with the thighs flexed with pillows kept under the knees during the entire stay in bed to relieve the strain from repair on the suture line. We have no uniform time to permit the patients to get up in, but most patients were kept in bed two weeks.

CONCLUSIONS

(1) In compiling the results of this series of inguinal hernias operated upon over a ten-year period, showing a recurrence rate of 7.24 per cent, we find that by individualizing the case we were able to lessen the recurrence rate materially. However, it is apparent that the longer the time that has elapsed since operation the greater is the number of recurrences.

(2) Differentiation as to type of hernia is important; operate only upon those direct hernias that require it. Do not operate upon bilateral hernias at the same time. Most of these are direct, either one or both sides, and the results are poor in either type.

(3) The duration of the hernia and the wearing of a truss is not a factor in the production of the recurrence.

(4) A chronic debilitated condition, associated with cough, is one of the factors in producing recurrences.

(5) Spinal anesthesia is the anesthesia of choice.

REFERENCES

1. Wadhams, R. P.; and Carraba, Victor: Herniorrhaphy Using a Living Fascial Flap. Ann. Surg., **101**:1264-1269 (May) 1935.
2. Watson, L. T.: Hernia. St. Louis: C. V. Mosby Co., 1924.
3. Bickham, W. S.: Operative Surgery, Vol. IV. Philadelphia: W. B. Saunders & Co.
4. Woolsey, Ross A.: Inguinal Hernia. Ann. Surg., **103**:812 (May) 1936.
5. Cattell, R. B.; and Anderson, Claude: End Result in the Operative Treatment of Inguinal Hernia. New Eng. Jour. Med., **205**:430 (Aug.) 1931.

DISCUSSION (*Abstract*)

Dr. Lucian H. Landry, New Orleans, La.—There has developed quite a medical literature on the subject of the so-called injection treatment of hernia in the past three or four years. Much "pamphlet mailing" by pharmacal companies has extolled the advantages of this mode of treatment and claimed the superiority of one solution over another. Such high-sounding and euphonious names as "pena mestre," "galtanol," "proliferol," "thuja," "O'Malley's solution" and others have been offered as "sure shots" with the elimination of pneumonia, embolus and other complications which follow in the wake of the surgical treatment of hernia.

Other advantages claimed by the injection treatment: (1) it is ambulatory and entails no income or time loss;

(2) cost is lessened by elimination of hospitalization; (3) best results comparatively in those types of cases where surgery records its highest percentage of failures; (4) safe, poor operative risks (heart disease, lung troubles, old age) are successfully treated; (5) technic easily acquired; (6) particularly valuable after surgical recurrence, and many other advantages.

This particular type of treatment was tried over one hundred years ago by Dr. M. Velpeau (in 1835), who used an iodine solution in an effort to produce an aseptic tissue proliferation. The method never developed any popularity or following, was later taken up by a number of quacks, and then faded out.

I can remember some thirty years back, when paraffin injections were done in an attempt to obturate the hernial orifice, and what a mess it was to get rid of them when the patient came to surgery.

A very high percentage of cures by the injection method is claimed by a number of recent writers. An article appearing in a Western journal cites 150 cases treated with 1 per cent recurrence. How he gets a case and a half, I can't figure out.

The best article I have been able to find on the subject appeared in the *Annals of Surgery* in September, 1937, written by Carl Burdick and Bradley Coley, who in 1934 started the injection treatment on a number of cases (66 with 92 hernias) at the Hospital for the Ruptured and Crippled, to see what it was all about.

Here is a man (Bradley Coley) who has been practically brought up on the inguinal canal. I am simply going to give you a few of his conclusions after giving the method a thorough trial:

Several solutions were tried, but no special value could be found in one over the other. The patients tolerated the injections well; few sequelae followed. Immediate results were gratifying in that the impulses disappeared, and for a time no definite evidence of a hernia was present. This brief period of encouragement would commence after five or six injections and would last for three or four months. However, in forty-seven of the fifty-six cases followed, a definite relapse was noted usually by the patient and the physician, so that at present only eleven cases are apparently cured, and nine of these are still wearing trusses.

To quote Coley further: "It is our belief, based on conditions found at operation on several cases previously injected, that it is extremely difficult to deliver the solution to the exact spot needed to obliterate the sac, and even when the solution does cause a temporary proliferation that either obliterates or masks the impulse, this tissue reaction gradually absorbs or diminishes until a state is reached approximating that which existed prior to the injection. * * *

"Until statistics are forthcoming that point to a much higher curability of hernia by the injection method than we have been able to obtain at the Hospital for Ruptured and Crippled, we have definitely decided to abandon the method entirely."

Dr. West (*closing*).—I agree with Dr. Landry, who included a quotation from a paper by Drs. Burdick and Coley, of New York, that gave a very vital criticism of this method of handling hernias, and they appear to be fair in their criticism.

MANAGEMENT OF PYELITIS OF PREGNANCY*

By H. K. TURLEY, M.D.
Memphis, Tennessee

The term, pyelitis of pregnancy, is accepted through long usage, though the pathology is that of stasis and what is known to us as pyelonephritis. The increased knowledge of infections and improved methods of studying the changes in the upper urinary tract in the past decade enable us better to control infection in pregnancy, with more safety for the mother and lowering of fetal mortality.

The methods of management are quite different from those employed with the non-pregnant. The hope of cure is limited to the first trimester. In the latter part of pregnancy, the control of infection until delivery is all that can be expected. We all accept the hypothesis of obstruction at the pelvic brim caused by enlarging uterus, producing dilatation and stasis in the upper ureter and kidney. The preponderance of right-side involvement has been attributed to the cushioning effect of the sigmoid, which prevents pressure on the left ureter as it crosses the psoas muscle and the brim of the pelvis. This dilatation begins early in pregnancy and may appear as early as the sixth week, according to Duncan and Seng. The usual appearance is about the sixth month, involving the ureter above the pelvic brim; then, as pregnancy progresses, the pelvis and calyces of the kidney become dilated.

Baird observed that dilatation was more marked in the primipara than in the multipara. The primipara, in subsequent pregnancies, may show less marked dilatation of the ureters. This Baird attributed to the response of the patient to a hormone which probably is estrin. This same hormone, he thinks, is responsible for the atony and diminished peristalsis of the ureter noted in the mid-term of pregnancy. Toward the latter part of pregnancy there is an increase in peristaltic action. This view coincides with the finding that there is a maximum of estrin in the blood from the fourth to the eighth month of pregnancy, after which it rapidly diminishes, thus explaining the increased tone and peristaltic action observed in the last month of preg-

*Read in Section on Urology, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

nancy and in the puerperium. That there is a true condition of atony, Baird explains by failure to find hypertrophy in the musculature of the ureter, which would be present if the problem were one of simple obstruction.

Lewis and Baker, in 1934, studying the urinary tract in a fairly large series of normal pregnancies by intravenous urography, came to the conclusion, as have Braash, Crabtree, Kretschmer and others, that the enlarging uterus causes pressure on the ureter at the pelvic brim, producing what might be termed a physiologic hydronephrosis.

Tumors and cysts, comparable to pregnancies and causing pressure on the ureters at the pelvic brim, produce similar changes in the upper urinary tract.

Where there is stasis in the urinary tract and bacteria gain access, infection results. The route of the bacteria has often been a much discussed problem. Many of these cases give a history of previous kidney infection, some of which may date back to childhood. These are considered exacerbations of a quiescent infection. Distant points of infection as teeth, tonsils, sinuses, constipation, gallbladder disease, appendicitis, endocervicitis and pelvic inflammations, all may be predisposing factors. The route of infection is either the lymphatic channel or blood stream. Some authors say that the urethra and bladder of pregnant women are infected in 70 per cent of cases, but on culturing the urine from the ureters growth is obtained in only 14 per cent. Some think that infected urine is regurgitated into the ureter and in this way infects the upper tract. There has been no dilatation or distortion of the ureter below the pelvic brim, since there is no cause for incompetence of the ureterovesicular valve and it has been the observation of most investigators that this phenomenon does not occur.

Many organisms may be responsible for invading the upper tract, but it has been our experience that the *Bacillus coli* is found most frequently, with staphylococcus second and streptococcus third. Baird is of the opinion that all infections are blood-borne from the bowel; that the bacteremia is of short duration and blood culture taken at the onset of fever before kidney symptoms have had time to develop will give a growth of organisms. He cautions against the use of irritating purgatives as a factor in producing kidney infections. These are often employed in the medical induction of labor and this method is possibly a cause of infection of the kidney in the puerperium.

With the advent of intravenous urography we are in much better position to understand the problems before us without delay or discomfort to the patient. Important information can be obtained by this means regarding anomalies, size, position and function of the kidney.

In the first trimester there is little or no delay in excretion by the kidney. Best plates are obtained in five to ten minutes. In the latter trimester best plates are obtained in twenty to thirty minutes. This delay is not so much a deficiency in kidney function, though there is evidence of delayed kidney activity in the last month of pregnancy, but rather to the fact that an inadequate amount of the excreted medium is sufficiently concentrated in the dilated pelvis and ureter to cast a dense shadow.

Function determination, by intravenous routine, is of questionable value, as stasis causes a retention of dye in the upper tract. The English rely upon urea excretion in the urine, while in this country more dependence is placed on the finding of nitrogenous retention in the blood. However, it must be remembered that elevation of nitrogenous products is a late symptom and often requires radical treatment if toxemia is to be avoided.

TREATMENT

For convenience, infections of the upper urinary tract may be divided into two classes. Those in the first trimester are usually most amenable to treatment and may be cured by urinary antiseptics. The uterus has not enlarged enough to cause pressure upon the ureter and produce stasis in that way. However, they should have a careful urologic study for the detection of obstructive conditions which may have existed prior to pregnancy, such as strictures of the ureter, stones, hydronephrosis or ptosis of the kidney. Anomalies may be present which are producing enough retention to need only the spark of infection to start the fire which may require drastic treatment to quench. Many have no obstruction, but respond to treatment and are often cured before the enlarging uterus has had a chance to produce obstruction. In the acute cases with fever, rigors, nausea and vomiting the best results have been attained by forcing fluids with alkalinization. If there is no response within 24 to 36 hours a cystoscopy is done and ureteral catheter drainage is instituted. Those requiring fluids should receive from 3,000 to 4,000 c. c. of 5 per cent glucose solution by

the intravenous route in addition to a glass of liquids every hour while awake. Often there is nausea and vomiting in which the intake by mouth is limited. In such cases a proper fluid balance must be maintained if diuresis is to take place, for all loss of fluids outside the urinary tract is at the expense of the kidney output and must be taken into account. Upon the patient's becoming afebrile the catheters are removed and antiseptics begun. It has been shown by Helmholtz, Clark and others that where the pH of the urine is lowered to 5.3 or lower it has become antiseptic. This may be accomplished in several ways. The ketogenic diet is not well adapted to all cases because nausea and vomiting are already associated with pregnancy. Several acidifying drugs have been used, the most satisfactory being ammonium chloride and methenamine or some of the mandelic acid preparations. Should mandelic acid alone not be sufficient to increase the hydrogen ion concentration to the desired point, ammonium chloride should be added. Since these cases may become afebrile under this regime, the fluids may be limited to 1,200 c. c., as this also will aid in increasing the acidity of the urine. This regime should not be continued over a long period of time, as symptoms of acidosis may develop. Pelvic lavage of the kidney may be carried out at ten-day intervals should the infection fail to respond to antiseptics. It is needless to say that this procedure should be carried out with the utmost gentleness, using soft pliable catheters, local anesthetic in the urethra and bladder, and belladonna and opium rectal suppositories inserted at six-hour intervals following cystoscopy until all likelihood of a reaction has disappeared.

After the fifth month of pregnancy, treatment is not aimed at a cure, but rather to control the infection until delivery. The enlarging uterus has begun to press upon the ureters at the pelvic brim, producing an increasing dilatation with stasis of the urine. Whether the infection be new or old, the chance of a cure is obviously hopeless. Interval cystoscopic treatment is of little or no value, since as soon as the ureteral catheter is removed the blockage of the ureter recurs. The small amount of antiseptic solutions used for lavage purposes, I am sure we all realize, never cured any pelvic infection of the kidney.

Cystoscopic treatment with catheter drainage is reserved for those cases of rigors, fevers and sweats which have failed to respond to posture in bed, diuresis and alkalinization. Those measures have usually been carried out before the urologist sees the case.

Pugh and others have advocated the use of large caliber catheters. I have found no occasion to use larger than a No. 7. These have given adequate drainage and will produce less discomfort to the patient. Due to the tortuosity or kink of the ureter it is often difficult and sometimes impossible to pass the catheter all the way into the kidney pelvis. If the catheter has passed the pelvic brim (the major point of obstruction), sufficient drainage will be obtained. To attempt to force a catheter all the way to the kidney pelvis may perforate the ureter at one of the acute angulations. As previously stated, the right side is most commonly affected and drainage of this side may be sufficient. Indwelling catheters are allowed to remain from 36 to 72 hours, depending upon the reduction of fever and toxic symptoms. It has been my practice not to irrigate these catheters because of the danger of carrying added infection into the kidney pelvis. Regardless of careful nursing, it is almost impossible to prevent contamination of the free ends of the catheters by bed linens or bed pans. In injecting these catheters at regular intervals one is almost sure to carry added infection into the kidney. When drainage has been established the catheter is answering its purpose. Why increase the danger of additional infection? The pain over the kidney, which is frequently caused by over-distention, is usually relieved by indwelling catheters. Should pain return it is possibly an indication for the removal of the catheter, as the dilated, over-distended ureter and kidney pelvis have regained some of their tone and contracted about the catheter, which has now become an irritating foreign body, and should be removed. Nausea and vomiting are often relieved by the catheter. This is possibly due to reflex action from the kidney such as sometimes occurs in vomiting associated with hydronephrosis. Allowing catheters to remain in place too long may be responsible for continued fever.

During the interval that the catheters are in place, the patient should receive sedatives for complete relaxation. This is accomplished as previously stated by belladonna and opium suppositories inserted into the rectum at six-hour intervals. This diminishes ureteral spasm which, by reflex action, may induce uterine contractions. Should the patient show an idiosyncrasy to opium, some form of barbiturate may be administered. Patients in the latter part of preg-

nancy are more apt to develop uterine contraction than those in the first trimester.

When the patient has acquired tolerance for her infection as manifested by subsidence of fever and toxic symptoms, the problem of preventing a return of symptoms presents itself. This is done by improving drainage as much as possible. It has been stated that catheter drainage is of value only while the catheters are in place.

Posture offers the best solution. It has been our practice to elevate the foot of the bed 12 to 14 inches. Use firm mattress and springs that do not sag, allowing only one thin pillow. The patient is to lie on her back, but is permitted to turn from side to side. In this position the weight of the uterus is displaced from the pelvic brim and at the same time pushes all of the abdominal organs up. The upward displacement of the kidney tends to stretch the tortuous and kinked ureters. Thus, by relieving the obstruction at the pelvic brim and the kinks in the ureter, improved tone in the ureteral musculature returns, resulting in an increased peristalsis in the ureter, thereby promoting better drainage from the kidney. The patient is required to remain in bed in this position until all pain and toxic symptoms have disappeared. After being allowed up she is required to spend two hours or more each day resting in bed in this position. Also at night the bed is maintained in the elevated position. This procedure is followed until she is delivered.

Baird recommends the knee chest position at intervals. This position, like indwelling ureteral catheters, is maintained for short periods of time and provides only intermittent drainage.

The following case illustrates the use of posture in controlling infection and aiding drainage until delivery:

Mrs. McN., para 2, was admitted to the hospital in June, 1937, in the sixth month of pregnancy, complaining of rigors, fever and sweats of one week's duration. For 48 hours there had been considerable pain and tenderness in the right costo-vertebral angle. Her symptoms responded within 36 hours to an indwelling right catheter, forced fluids and alkalinization. The foot of the bed was elevated 14 inches after removal of the catheter. Her condition continued to improve and she was discharged from the hospital with instructions to rest two hours a day and sleep at night with the foot of the bed elevated.

In September her physician reported that she was delivered of a healthy child and there had been no return of her symptoms since she left the hospital.

Urinary antiseptics are of value in helping to control infection. Methenamine combined with some acidifying drug, as ammonium chloride or mandelic acid, is usually well tolerated. These drugs are used as in the first trimester of pregnancy. Intravenous use of methenamine in doses of 60 grains a day combined with mandelic acid has been of value in stubborn cases.

One of the important factors in treatment is the prevention of a severe secondary anemia. Following acute febrile attacks of pyelitis, a marked drop in the red cell count and hemoglobin is frequently noted. To maintain a good defense against infection the blood picture should be within normal limits. Blood transfusions have been the most satisfactory method of maintaining this blood level. Particularly is this true if any operative procedure is contemplated.

In cases which do not respond to treatment, drainage by catheter or posture is employed, and where there is a progression of toxic and febrile symptoms, the pregnancy should be terminated. This, I feel, is the method of choice, as there is usually an immediate relief of symptoms, and often the life of the mother and sometimes the child is saved by induction of labor. To allow toxic and febrile symptoms to continue will precipitate a miscarriage with dead fetus and perhaps the loss of the mother's life or irreparable damage done to the kidneys which may require surgery at a most hazardous time. Surgery, in my opinion, should be avoided as much as possible. Nephrostomy can be resorted to in those cases in which the pregnancy must be preserved. In my experience, nephrostomy or nephrectomy is usually followed by a miscarriage and dead fetus, occurring usually at a time in which the patient is in no condition for such a double ordeal.

Surgery on the postpartum patient should be withheld in the elective cases until such a time as the kidney and ureter have had a chance to regain their muscular tone. This may require 90 days or more. Pyelo-ureterograms made then and compared with those made during pregnancy will often show that the upper urinary tract has returned to normal, or nearly so, with a corresponding return of kidney function. Cases which do not return to normal are usually associated with anomalies or obstruction. For these, the indicated methods of treatment should be

carried out as soon as the patient's condition permits.

CONCLUSIONS

(1) Pyelitis of pregnancy may be cured in the first trimester of pregnancy. In the latter half, only control of infection can be expected.

(2) Forced fluids, alkalinization and indwelling ureteral catheters afford best results in febrile cases.

(3) Posture treatment aids drainage, prevents recurrence of febrile attacks and relieves pain.

(4) In cases that do not respond to treatment, the pregnancy should be terminated.

(5) Kidney surgery is poorly borne in pregnancy and should be resorted to only in urgent cases.

REFERENCES

1. Duncan and Seng: Jour. Obst. & Gyn., **16**:557, 1928.
2. Baker and Lewis: J.A.M.A., **104**:812, 1935.
3. Kretschmer, H. L.: Surg., Gyn. & Obst., **33**:627, 1931.
4. Trout and McLane: Amer. Jour. Obst. & Gyn., **33**:828, 1937.
5. Pugh, W. S.: Jour. Urol., **18**:553, 1927.
6. Baird, D.: Jour. Obst. & Gyn. British Empire, **43**:435, 1936.
7. Baird, D.: Jour. Obst. & Gyn. British Empire, **42**:577, 1935.
8. Reinberger and Anderson: Neb. State Med. Jour., **22**:328 (Sept.) 1937.
9. Livermore, G. R.: Sou. Surgeon, **2**:110, 1933.
10. Braash, W. F.: Urography. Philadelphia: W. B. Saunders Co., 1927.
11. Crabtree, Proctor and Prien: Amer. Jour. Surg., **38**:50, 1937.
12. Hinman, Frank: Principal and Practice of Urology. Philadelphia: W. B. Saunders Co., 1935.
13. Corbus, B. C.; and Danforth: Jour. Urology, **18**:543, 1927.
14. Helmholz, H. F.: Surg., Gyn. & Obst., **55**:449, 1932.
15. Dodds, G. H.: Jour. Obst. & Gyn. British Empire, **39**:46, 1932.

601-11 Medical Arts Building

DISCUSSION (*Abstract*)

Dr. M. Q. Ewing, Amory, Miss.—It occasionally occurs that a case of pyelitis of pregnancy refuses hospitalization and catheter drainage. When this occurs the physician has a dilemma on his hands and up to now treatment other than therapeutic abortion has been futile. It has been my misfortune to have two such cases within the past year. Both were quite toxic with chills and fever, at about the fifth month of pregnancy. Both cases were treated with sulfanilamide. The infection subsided and temperature was normal in forty-eight hours and there was no recurrence of the infection and no toxic symptoms. One patient has been delivered and the other is in her last month with no further evidence of trouble.

I report these two cases for what they are worth and have no conclusion to submit.

Dr. Turley (closing)—I have had no experience with sulfanilamide in pregnancy. It is a very toxic drug and should be watched carefully in its administration.

AN ANALYTICAL STUDY OF 310 CONSECUTIVE HYSTERECTOMIES*

By THOMAS B. SELLERS, M.D., F.A.C.S.
JOHN T. SANDERS, M.D., F.A.C.S.
New Orleans, Louisiana
and
JAMES W. WELCH, M.D.
Alexandria, Louisiana

The mortality and immediate morbidity in the hysterectomy operation are still higher than should be for an elective operative procedure, and many patients who recover fail to regain health and nervous stamina. Realizing that a careful analysis of past results often suggests a means of improvement, we are reporting a study of 310 additional hysterectomies. These were done at the Southern Baptist Hospital from January, 1933, to June, 1937 (first report[1]) and were divided among the various operators as follows:

217 (70 per cent) by 5 surgeons and their associates
93 (30 per cent) by 43 surgeons, occasional operators at this hospital

Tables 1 and *2* give the indications, age incidence and type of operation for the cases in this report. (The total number of indications exceeds the number of cases, because the majority of them presented several pathologic conditions.)

Table 1
INDICATIONS

	Supravaginal	Vaginal	Pan Hysterectomy	Fundectomy	Total
Fibroids	136	14	20	3	173
Fibrosis uterus (usually associated with retroversion and procidentia)	127	32	27	6	192
Procidentia (*per se*)	7	37			44
Carcinoma of fundus	4		5		9
Carcinoma of cervix			2		2
Polyp (uterine)	3	3	2	1	9
Endometriosis	10	2	2	2	16
Salpingo-oophoritis with or without massive pelvic adhesions	67	4	14	3	88
Retroversion	16	1	3	1	21
Poro section	3				3
Ruptured uterus	1				1

*Read in General Clinical Session, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

Table 2

TYPE OPERATION WITH AGE INCIDENCE

	Supravaginal Hysterectomy	Vaginal Hysterectomy	Pan Hysterectomy	Fundectomy
20-29 years	15	1	3	3
30-39 years	101	9	15	3
40-49 years	74	20	18	3
50-59 years	16	8	3	0
60-69 years	0	9	2	0
70 years and above	0	1	0	0
Age not given	5	1	1	0
Total number cases	211	49	41	9
Per cent	68.1	15.8	13.2	2.9

Uterine fibroids, fibrosis of the uterus, and chronic inflammatory disease were the chief indications for the supravaginal operation (*Table 1*). It will be noted in *Table 2* that in 175 cases this operation was done between the ages of 30 and 49 years, the greatest number occurring in the first of the two decades. The indications and the age incidence for the panhysterectomy parallel that of the supravaginal operation, but the number of cases is smaller because the complete operation is usually considered more formidable. The fundectomy was most commonly done in cases with little disease; in younger women, where it was desirous to preserve the menstrual function, and in older women with a retroversion associated with a large boggy uterus (*Table 1*). It occurred equally in the three decades between 20 and 49 years (*Table 2*). As shown in *Table 1*, the most frequent conditions for the vaginal operation were in cases with some degree of procidentia associated with fibrosis and small fibroids. Between the ages of 30 and 59 years, there were 37 cases, while between 60 and 69 years, there were 9 cases, which was 81.8 per cent of the total operations for this age group. This is due to the fact that the vaginal operation is attended by a much lower mortality in old women than the abdominal type.

Of the 11 cases with carcinoma, 4 had the supravaginal hysterectomy and it is assumed that cancer was found in the routine pathologic examination, since the complete operation is the accepted ideal procedure in most operable cases of fundal cancer. Five fundal and 2 cervical carcinomata were treated with that operation.

It is interesting to note that endometriosis occurred in 5.2 per cent of the total cases.

Morbidity.—Selecting 101° F. as a reasonable basis for morbidity in pelvic surgery, cases with this degree of fever or more were counted febrile, while those up to that level were considered afebrile. Complications, such as kidney infections and infected wounds, were excluded. In 129 cases (41.3 per cent), the temperature was never as high as 101°. The remaining 58.7 per cent had that much fever for one day or more; some as long as 15 days postoperatively. From *Table 3*, the morbidity for the various operative procedures will be seen:

In this series, the lowest morbidity was found in the panhysterectomy group, followed closely by the fundectomy series, while the highest temperatures were seen in cases having the supravaginal and vaginal operations. Although the difference is not great, a possible explanation lies in the fact that the supravaginal operation is the one of choice in cases with adhesions and extensive chronic inflammatory conditions. In the

Table 3

Temperature	Supravaginal Hysterectomy		Pan Hysterectomy		Vaginal Hysterectomy		Fundectomy		Total	Per Cent in Temp. Group
	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent		
Never above 101° F.	85	40.3	19	46.3	21	43	4	44.4	129	41.3
1 day above 101° F.	58	27.5	15	36.6	12	24.5	4	44.4	89	28.8
2 days above 101° F.	28	13.2	2	4.9	7	14.3	0	0	37	12.0
3 days above 101° F.	21	9.9	4	9.8	5	10.2	1	11.1	31	10.1
4 days above 101° F.	8	3.8	1	2.4	3	6.1	0	0	12	3.9
5 or more days above 101° F.	11	5.2	0	0	1	2.0	0	0	12	3.9
Total febrile	126	59.7	22	53.7	28	57.0	5	55.6		

vaginal group, the extensive plastic surgery and older patients with low tissue resistance, probably offer the explanation.

Mortality.—There were 7 deaths in the series, 5 in the supravaginal and 1 each in the panhysterectomy and vaginal groups.

Table 4
MORTALITY

		Total	Per Cent
Supravaginal		5	2.37
20-29 years	1		
30-39 years	2		
40-49 years	1		
50-59 years	1		
Vaginal			
75 years	1	1	2.04
Panhysterectomy			
40-49 years	1	1	2.44
Rate for entire series (uncorrected)			2.26
Corrected mortality for this series			1.6*

*This compares with 4.4 per cent and a corrected rate of 2.9 per cent in a previous report[1] from the same hospital by Sellers and Rinaman.

The first supravaginal death occurred in a woman of 47 years, who was operated upon because of fibroids, and developed a cardiac complication and died on the ninth day postoperatively. She had a temperature of 101° for one day and otherwise was apparently normal. The second supravaginal death was in a 52-year-old patient with an extensive carcinoma which had already metastasized. A third death (supravaginal) occurred in a patient who had a ruptured uterus following a criminal abortion, and died on the third day due to loss of blood and infection. The fourth death (supravaginal) was due to a paralytic ileus in a 34-year-old woman, whose physical condition was normal other than 60 per cent hemoglobin and 2,600,000 red blood count. She received several postoperative blood transfusions. The fifth patient (supravaginal) died without any explicable reason. The death in the vaginal group was in an elderly woman of 75 years, and was due to acute myocardial failure. The death in the panhysterectomy series was due also to myocarditis in a woman 46 years of age. The second and third deaths of the supravaginal cases should not be charged to elective hysterectomy mortality.

The mortality rate in this series compares favorably with other reports in the literature. In a previous report by Sellers and Rinaman,[1] the gross mortality was 4.4 per cent and a corrected rate of 2.9 per cent in a series of 272 cases. In a series of 262 hysterectomies reported by Grad,[2] there were six deaths with a rate of 2.2 per cent. Burch[3] reported a mortality rate of 4.5 per cent in 200 cases. Reid and Bell[4] have reviewed the recent literature on hysterectomies, comparing the mortality rate of the subtotal versus the total hysterectomies, as shown in *Table 5.*

Table 5 (From Reid and Bell)

Author	Number of Cases		Percentage Mortality	
	Subtotal	Total	Subtotal	Total
Fullerton and Faulkner	609	1076	4.4	4.1
Shaw, W. F.	232	67	3.05	5.9
Weibel	?	?	4.25	3.55
Amreich	1253	409	1.6	3.8
Masson	217	229	1.8	1.3
Burch and Burch	166	32	4.2	3.1
Reid and Bell	1739	605	2.1	3.1
This report	259	41	1.6 per cent*	

*Corrected.

Discussion.—The fact that the mortality in the hysterectomy operation varies in different hands leads one to think that definite routines are necessary before and after operation. The operation in the majority of instances is an elective one, and as such there is little reason for immediate surgery before the patient has been thoroughly studied and prepared. A few cases of severe acute bleeding may require heroic attempts at life saving measures, but even here massive preoperative and postoperative blood transfusions will be advantageous. A complete outline of a sound routine follows:

(A) *Preoperative Care.*—The preoperative examination should include a complete physical, especially the heart, blood study, kidney function and urinalysis. In older women, preoperative blood sugar determination should be a routine. The blood study cannot be emphasized too strongly, as the mortality in many cases is directly proportional to the degree of anemia. No patient should be operated upon whose hemoglobin is less than 70 per cent and whose red blood count is below 3,500,000 per cu. mm. Blood transfusions beforehand are invaluable in accomplishing this. Massive transfusions of 1,800 c. c., using three donors, are of great value in patients who are extremely anemic, with a tendency to extensive or protracted hemorrhages. They are operated upon within 24 hours after the blood has been given. All vaginal foci of infection should be eradicated and in cases with procidentia a 6- to 8-day bed confinement is advised to permit a return of the tissues to as nearly a normal state as is possible.

Inasmuch as this is usually an elective procedure, adequate psychological preparation is most important to overcome fears and apprehension. In some cases, postponement is advisable until these phobias are allayed. Detailed instructions should be given as to the dietary, emphasizing the importance of an easily digested, balanced diet; fruits and alkalies for 48 hours before. We condemn purgation the night before the operation. Instead, the purgative is given 48 to 96 hours preoperatively in order to allow for a return of peristaltic balance and complete mental and physical rest the day prior to the operation. Sedation is necessary to assure this rest. Patients should be prepared the night before, including enemata and douche, and should not be disturbed in the early morning.

BLOOD PRESSURE INDEX

As a basal anesthetic, 1.5 c. c. paraldehyde per 10 pounds of body weight, thoroughly mixed with 3 ounces cooked starch solution is administered by rectum at least one hour before the operation, and morphine sulphate, grains ¼, with scopolamine hydrobromide gr. 1/150, 30 minutes before going to the operating room. A barbiturate may be substituted for the paraldehyde.

The anesthetic must be chosen according to the patient's condition and the selected operative procedure. The one of choice is general, using cyclopropane or ethylene with ether if necessary. Spinal may be of especial value in obese patients with deep pelves, notwithstanding that it is considered less safe by most operators. Local is unquestionably the safest of all anesthetics and is particularly adapted to vaginal hysterectomies with marked procidentia.

One must individualize in selecting the type of operation. Vaginal hysterectomy offers the lowest mortality of all the procedures, when the conditions are favorable and the indications are not forced. This is especially true in elderly women, as it can be performed under local anesthesia with little or no shock. When there is additional abdominal and pelvic disease, the abdominal operation is preferable, selecting the supravaginal or total operation. Where there is extensive plastic work, as well as pelvic, with a relatively poor risk, a two-stage operation should be considered. A disadvantage of this latter procedure is that many patients have a tendency to fail to return for the second operation, and there is of course increased pecuniary outlay. However, it may be advisable, especially in the hands of the occasional gyneplastic operator. Fundectomy has a limited field and is reserved for young, menstruating women with disease of both tubes, and older women, where a hysterectomy is not indicated.

The scope of this paper permits only generalities in the operative details. The time element is important, but gentleness and meticulousness should not be sacrificed for speed. The most important factor in lowering both the morbidity and mortality is conservation of blood, especially where plastic work is done before the abdominal operation. This can be partially accomplished by the use of epinephrine (5 minims to 1 ounce) in normal saline, injected submucously in anterior and posterior colporrhaphies, and 1 to 2 c. c. of pituitrin in the cervix prior to any cervical operation.

(B) *Postoperative Care.*—On leaving the operating room, the patient should be well wrapped and under the constant care of a trained attendant until consciousness has been regained. Although body heat is to be kept up, excessive loss of fluid by overheating is to be avoided.

Morphine, gr. ¼, is given every 4 to 6 hours, except in susceptible patients and older persons. Nothing is allowed by mouth for the first six hours, and then only tap water for 12 hours. Fat-free broth and hot tea with dextrin are permissible after 12 hours. Three to 4 days later, strained cereals, gelatin and dry toast may be given.

Three thousand c. c. of 5 per cent glucose in Hartmann's solution are given by vein during the first 24 hours, afterward 1,000 to 3,000 c. c. of the same solution with or without Hartmann's, as may be indicated by the oral intake and the level of the blood electrolytes as is determined by chemical analysis. Care must be taken in using salt or Hartmann's, because of the likelihood of retention of fluids with electrolytes. One unit of insulin to each 3 gm. glucose is routine.

The patient is catheterized every 8 hours for 2 or 3 times, even when she is also voiding, to insure complete emptying of the bladder in cases that have had anterior colporrhaphies, to prevent overstretching of tissues, cystitis and back pressure on the kidneys.

Dry or moist heat over the abdomen for one hour six times daily until peristalsis is reestablished is invaluable. The heat tent is a convenient means of obtaining this, except in hot weather, when stupes are preferable.

The rectal tube is beneficial if there is a tendency to distention. Refrain from flushes for at

least 72 to 96 hours. Pitressin may be given in selected cases.

The Jutte tube should be inserted early in all cases with the slightest gastric retention or abdominal distention. Often it is wise to permit its passage into the jejunum. Bartlett's continuous gastric suction will aid inestimably in maintaining the desired deflation.

Change of position every 3 or 4 hours rests the patient and is of value in preventing thrombophlebitis and hypostatic pneumonia in elderly women. Small doses of thyroid have been found beneficial in all cases past the fourth decade, along with 5 c. c. of insulin three times daily, except in cases with hypoglycemia. In the case that is not a good risk, postoperative blood transfusions are desirous. They may be given singly or multiply as the indications warrant. It is necessary that the patient's blood be rematched before each transfusion, even though a donor was compatible before the first.

REFERENCES

1. Rinaman, J. C.; and Sellers, T. B.: Amer. Jour. Surg., **27**: 282-288 (Feb.) 1935.
2. Grad, H.: Amer. Jour. Obst. & Gyn., **31**:150-152 (Jan.) 1936.
3. Burch, L. E.; and Burch, J. C.: Amer. Jour. Obst. & Gyn., **21**:704-708 (May) 1931.
4. Reid, C. D.; and Bell, A. C.: Jour. Obst. & Gyn. British Empire, **40**:749-767 (Aug.) 1933.

FURTHER OBSERVATION ON INTENSIVE RADIATION OF HYPERTHYROIDISM*

By S. C. BARROW, M.D.
Shreveport, Louisiana

Despite the 85 to 95 per cent cures in cases of hyperthyroidism treated by radiation and the unanimity of opinion of those who have carefully studied the results, the argument as to the relative merits of radiation and surgery still goes on.

We recall that in 1922 Dr. John G. Clarke made the statement that the treatment of uterine carcinoma was a radiological problem, yet it has taken fifteen years to convince good surgeons and possibly it will take fifteen more to convince the average, that he was right. No doubt history is repeating itself in the treatment of hyperthyroidism as it has repeated itself in many conditions other than uterine carcinoma.

*Read in Section on Radiology, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

Dr. J. Thompson Stephens[1] reports the radiological treatment of 360 cases of hyperthyroidism with 90 per cent cures. Thirteen per cent of these cases had been operated upon and had recurrences.

Dr. George Pfahler[2] reports 698 cases with 87.9 per cent cures.

Dr. Christie[3] reports 305 cases with 88.85 per cent cures.

The literature is now so full of similar results that it would seem useless to carry the argument further. The results of these authors are paralleled closely by all who have followed this method of treatment. These are cited merely as examples.

Means and Aub,[4] after analyzing cases treated at the Massachusetts General Hospital, draw the conclusion that surgery should be used only after the x-ray has failed.

Dr. Crile[5] himself writes in his book, "The Thyroid Gland:"

"From a study of the evidence offered by those who advocate x-ray treatment of hyperthyroidism and a consideration of our experience, we believe the surgical treatment with physiological rest yields the most favorable results."

From this expression it is evident that he is not fully convinced.

Dr. C. D. Christie,[6] a member of Dr. Crile's staff, analyzed a group of Dr. Crile's operated cases and found the following: Before operation, the average basal metabolic rate was 58.1 and pulse 113. Two months after operation, the average basal metabolic rate was 24.4 and pulse 96.

We submit that a patient with a basal metabolic rate of 24.4 and a pulse of 96 should not be classed as well.

Dr. Israel Bram,[7] of Philadelphia, discusses 5,000 cases of hyperthyroidism that have come under his observation since 1910 and reports 117 which have been operated upon and 9 which have been x-rayed. This observation appeals to the writer as very significant.

In toxic goiter where there is a true hyperplasia, an increase in the normal number of cells with normal function, resulting in an excess of thyroxin, radiation is indicated.

In true Graves' disease where we have no increase in cells, no hyperplasia, but an overactivity of the cells, radiation is indicated.

In toxic adenoma where there is both increase in number of normally functioning cells and also

an over-function of other cells, radiation is indicated.

All of these result in hyperthyroidism and should be controlled by radiation rather than operation.

Among all the varied arguments brought forward by those who oppose radiation in hyperthyroidism, there is but one that has deserved consideration and that is the time consumed in bringing the patient to a non-toxic state.

Those authors whom we have quoted above, and practically all others, use small doses and long intervals, consuming from 4 to 6 months and more, to overcome the patient's toxicity. We believe this time can be and should be lessened.

The object of the surgeon has been to remove, abruptly and with one stroke, the source of toxin, the thyroid gland. It has not been argued that the removal of the thyroid gland, *per se*, the abrupt release of the organism from its toxic materials and contents, was deleterious to the patient.

Why not, then, as abruptly as possible and with as few strokes as possible, suppress the source of toxicity by radiation?

By means of more intensive treatments or the usual dosage more frequently applied, the toxicity of the average case can be overcome in 6 to 8 weeks. Using 100 to 125 kilovolts with 3 to 4 mm. aluminum filter, 250 r may be administered weekly from 6 to 8 weeks or more, a total of 2,000 to 3,000 r, with no chance of a skin reaction. With 200 kilovolts ¾ mm. copper filter, 500 r may be administered weekly for 4 to 6 weeks with only slight, if any, skin reaction.

These doses may be doubled by using different ports, with no damage to skin resulting. If one determines the basal metabolic rate before each treatment, and observes carefully the general reaction of the patient, no danger of overdosage will result. We have given as much as 5,000 r to the thyroid area, using high voltage and ¾ mm. copper filter, within 6 weeks by using three ports.

It must be remembered that all cells of the thyroid are never diseased or hyperfunctioning in a case of hyperthyroidism and that the normal group are extremely resistant to radiation. These cells will carry on regardless of heavy dosage and when myxedema does occur, or prolonged hypothyroidism, it is the reaction following prolonged hyperfunction and not radiation. In the treatment of malignancies around the neck areas where extremely heavy dosage is used, we rarely, if ever, see myxedema result, neither any ill effects on the parathyroids. The resistance to radiation of normal thyroid cells is well known and has been many times proven.

It must be remembered that hyperthyroidism is probably not a disease of the thyroid gland alone. It is again recognized that the thyroid gland, in maintaining equilibrium among the ductless gland family, is a necessary organ. Its total removal, therefore, seems illogical. A suppression of its activities seems logical. The removal of the greater part of the thyroid means that those cells left must maintain excessive function the remainder of the patient's life to supply the proper amount of thyroxine and probably other elements not yet known.

From a logical and scientific standpoint, the argument in favor of radiation is faultless. From the standpoint of final results, only one faulty link in our argument exists. Our patients remain toxic too long. This can be overcome by more intensive treatments or the usual intensities more frequently applied.

Before the Louisiana State Medical Society in 1935 we presented two charts on this same subject, illustrating the results of radiation by more intensive technics than are usually followed. *Chart 1* is reproduced here and very graphically shows what a low intensity but frequently applied dose can accomplish.

Chart 1

LOW INTENSITY RADIATION FREQUENTLY APPLIED
107 kilovolts, 3 mm. al, right-left anterior lateral

Date in 1922	Pulse	Tremor	Exophth.	Enlargement	Wt. in Lbs.	Basal Met.	r	Medication Quinine
3/21	140	4+	2+	2+	85	?	235	√
3/28	140	4+	2+	2+	85	?	√	√
4/ 6	130	2+	2+	2+	88	?	√	√
4/13	120	1+	2	1+	88	?	√	√
4/20	100	1	2	1+	94	?	√	√
5/ 4	100	1	1	1	96	?	√	0
5/18	80	0	1	0	100	?	√	0
6/ 8	80	0	0	0	104	?	√	0

From March 1 to May 18, or 8 weeks, the patient's pulse dropped from 140 to 80, her tremor, exophthalmos and thyroid enlargement

disappeared and her weight increased from 85 pounds to 100 pounds. After 15 years she remains well save for a crippled heart, which she brought with her.

Charts 2, 3 and *4* show the record of more recent cases treated still more intensively. Here we see the results following high voltages, heavier filtration and total roentgens delivered.

Chart 2 shows results of a rather resistant case, but becoming non-toxic in 10 weeks, a total of 4,000 r being given. She is in perfect health at this time.

Chart 3 shows results following 4,200 r, the non-toxic state reached in 5 weeks.

Chart 4 shows how differently cases may react. This patient received only 2,400 r and was non-toxic in 4 weeks. Some criticism may be directed for giving the second dose, since her basal metabolic rate was only plus 10. However, we felt, I think correctly, that she would have relapsed had the second dose not been given.

In all of our postoperative cases and others resistant to treatment, foci of infection have been found present. After their removal or correction, response has been prompt. Our cases are given quinine, but not iodine, and we attempt to have them take proper rest and remove irritating surroundings as much as possible.

Chart 2

CASE NON-TOXIC IN TEN WEEKS
200 kilovolts, ¾ mm. Cu, 4,000 r. Three portals

Date in 1936	Pulse	Tremor	Exophth.	Enlargement	Wt. in Lbs.	Basal Met.	r	Medication Quinine
6/13/36	130	3+	1+	1+	98	+44	1500 r	
6/20/36	110	3+	1+	1+	95½	+37	900 r	
7/ 4/36	100	2+	1+	1+	95	+30	600 r	
8/ 1/36	100	1+	1+	1+	95	+30	600 r	
8/15/36	100	1+	1+	1+	98	+32	400 r	
8/31/36	80	0	+	+	103	+1	0	0
10/ 8/36	80	0	0	0	113	—12	0	0
11/30/36	78	0	0	0	112	— 5	0	0

Chart 3

CASE NON-TOXIC IN FIVE WEEKS
200 kilovolts, ¾ mm. Cu, 4,200 r. Three portals

Date in 1936	Pulse	Tremor	Exophth.	Enlargement	Wt. in Lbs.	Basal Met.	r	Medication Quinine
6/24/36	110	2+	0	2+	132	+20	1500	
7/ 1/36	110	2+	0	2+	?	?	900	
7/8/36	110	2+	0	2+	130	+27	900	
7/15/36	110	1+	0	+1	129	+24	900	
7/29/36	88	0	0	1	127	+ 5	0	0
8/26/36	80	0	0	0	130	+ 5	0	0

Chart 4

CASE NON-TOXIC IN FOUR WEEKS
200 kilovolts, ¾ mm. Cu, 2,400 r. Three portals

Date in 1936-37	Pulse	Tremor	Exophth.	Enlargement	Wt. in Lbs.	Basal Met.	r	Medication Quinine
7/20/36	130	2+	1+	1+	123	+36	1500	
8/ 3/36	84	1+	1+	1+	125	+10	900	
8/17/36	80	0	1	1	129	0	0	0
9/14/36	80	0	0	0	132	0	0	0
1/19/37	76	0	0	0	136	0	0	0

In all of our postoperative cases and others resistant to treatment, foci of infection have been found present. After their removal or correction, response has been prompt. Our cases are given quinine, but not iodine, and we attempt to have them take proper rest and remove irritating surroundings as much as possible.

REFERENCES

1. Stephens, J. Thompson: Arch. Physical Ther. (May) 1935.
2. Pfahler, Geo.: Ann. Int. Med. (Jan.) 1934.
3. Christie, C. D.: J.A.M.A. (May 25) 1929.
4. Means and Aub: Crile's The Thyroid Gland.
5. Crile: The Thyroid Gland.
6. Christie, C. D.: Crile's The Thyroid Gland.
7. Bram, Israel: Clinical Med. & Surg. (Nov.) 1937.

DISCUSSION (*Abstract*)

Dr. I. Warner Jenkins, Waco, Tex.—For seventeen years I have been treating hyperthyroidism by x-radiation. At my first attempt to discuss this subject before my own (Texas Medical) Association, I was almost thrown out, and was allowed only one minute to close the discussion of my paper. I merely refer to this incident to show how unpopular my subject was at that time.

Even though I always started a near riot between myself and the surgeons present, I have never failed to present x-ray as the method of choice in the treatment of hyperthyroidism. Through the years, since 1920, many independent radiologists have had great interest in this form of treatment, and many thousands of cases have been so favorably reported that I wonder how anyone can still oppose our method. There can be only one of two reasons: the opponent is either selfish or uninformed. In the main I agree with Dr. Barrow, but still I have an idea that unfavorable results occasionally come from the too sudden drop from a high to a low metabolic rate. I have an idea that a different mortality rate would obtain if those who do total or subtotal thyroidectomies would guard against the sudden drop in metabolism by frequent metabolic readings and by the administration of thyroxin in sufficient dosage to allow a gradual decline in the metabolic rate. It is the sudden change in any condition that may produce a shock and perhaps death. To administer to, or take from one, a poison to which the patient has become accustomed may produce a grave situation. It is dangerous to anesthetize too quickly with ether. The sudden

shock may produce death. To withdraw morphine from the addict too quickly may produce death. To descend or ascend too quickly and to too great depth or height may be a dangerous thing to do. I hold that a patient with a metabolic rate of say plus 75 reduced quickly by surgery to zero or plus 10 is in a dangerous condition, and I feel very confident that certain hospital records that show a 13 per cent mortality from surgery of the thyroid could be greatly lowered if the surgeon would prevent the too sudden drop in the metabolic rate. It is not my province to tell the surgeon how to show a more creditable mortality, but I am here to tell you that Dr. Barrow and his fellow radiologists have practically no mortality and should have the right of way in perhaps 80 per cent of cases of hyperthyroidism.

I, personally, have been employing a medium high voltage with 4 mm. aluminum filter as an x-ray working basis. I have preferred to give myself from three to six months to relieve my patient. If I could always be sure that the thyroid patient did not have some other associated endocrine disorder, then I, too, would prefer, probably, a one, two or three treatment method. But, sometimes we find as our trigger mechanism, too wild a thyroid with a pituitary, ovary or a suprarenal disease as a complication. I once saw a patient 26 years old with a basal metabolic rate of +110 who recovered in two months' time, and all the treatment she had was adrenal cortical extract three times a day. She has now been well two years. I have seen many young women recover from a thyrotoxicosis with a basal metabolic rate of +45 when the thyroid had a very small amount of radiation and the pelvis enough to produce a menstrual rest. Many of my patients with a well marked hyperplasia of the thyroid and advanced exophthalmos have recovered after x-radiation of the thyroid and ovaries. In some of these the basal metabolic has returned to approximately normal, while the thyroid remained enlarged and the heart remained rapid. At this point anterior pituitary-like sex hormone was administered, the gland reduced to normal size, and the heart rate restored to normal.

Many failures occur because cases are improperly diagnosed. The thyroid was secondary and not primary in the syndrome. Hyperthyroidism is not always an entity in itself; the thyroid may have an accomplice in some other of the endocrine system. Mr. Surgeon: if you have a recurrent goiter you can give yourself credit for being a poor diagnostician; and Mr. Radiologist: if you do not cure your patient, you can likewise discredit your diagnostic ability.

It seems now that the non-toxic colloid goiter may be wholly or greatly reduced by proper treatment which may be neither surgery nor x-ray. My reason for preferring moderate to intensive x-ray treatment is that before I have done a great deal to my thyroid I will have had time by a test of trial and error to have come to a sound diagnosis of my patient. In other words, it may take a little while to make a satisfactory diagnosis, at which time I will decide that the thyroid is or is not wholly to blame for the patient's condition.

Dr. Stakely Hatchette, Lake Charles, La.—I heartily agree with Dr. Barrow that large doses of x-ray should be given if necessary. While I have not been a specialist in our field for long enough to draw examples from my own private patients, I have several patients under treatment at this time to whom I expect to give as many as 5,000 r measured in air if I believe it to be necessary. I have just returned from a year of postgraduate study of radiology in the East, and I have seen a number of patients in the hospitals of Philadelphia and New York who have received such doses without ill effects. Large doses of irradiation have also been administered to the thyroid glands of laboratory animals. Fractional doses up to 8,000 r measured in air have been reported without gross or microscopic evidence of injury to the cells of normal thyroid glands.

All of the cases of hyperthyroidism that I saw under treatment in Philadelphia were first seen by surgeons and were referred to the radiological department of the various hospitals for irradiation before any kind of surgery was considered.

Dr. Ralph E. Myers, Oklahoma City, Okla.—The well-recognized fact that the thyroid does not cover all of the picture has caused me to hope for a more logical method of attack than a treatment directed at that organ alone. It is quite evident that this attitude of mind has resulted in my pushing the roentgen therapy of the thyroid itself too much in the background. Dr. Barrow has certainly attained very commendable results without worrying too much about the other very elusive factors which contribute to thyroid dysfunction.

That such factors do exist, and that at times they provide the impetus for hyperthyroidism, is well shown by the case which I shall cite. A little over two years ago a young woman was referred to me for therapy. She complained of a feeling of pressure in her throat, of nervousness and of marked lassitude. Her thyroid showed slight enlargement, she had a rapid pulse (about 120), ran a little temperature and was distinctly underweight. Roentgen therapy over the thyroid was followed by a disappearance of her temperature and some lowering of her pulse (95-100), but otherwise very little change.

Somehow in getting her history I had failed to elicit the fact that she was always troubled with dysmenorrhea at her periods. She was given some theelin intramuscularly just prior to her next period with surprising results. Not only was the menstruation painless, but the feeling of lassitude had disappeared. A couple of days after the injection her pulse dropped to normal. Her weight, which had been stationary, now began to increase.

I quite agree with Dr. Jenkins that we should not center our attention wholly on the thyroid.

Dr. Barrow (closing).—The object of the presentation was to urge a more intensive treatment than that usually applied in order to bring the patient to a nontoxic state more quickly.

The only logical argument against radiation is the fact that several months are usually consumed in the treatment. By more intensive dosage, six to eight weeks usually suffices.

THE RATIONAL TREATMENT OF ACNE VULGARIS*

By GAROLD V. STRYKER, M.D.
and
MANUEL G. BLOOM, M.D.
St. Louis, Missouri

The therapy of acne vulgaris has been characterized by waves of enthusiasm for one therapeutic procedure after another. These therapeutic periods may be divided into three parts: the bacterial, the mechanical, and the hormonal. Underlying these three more evident phases, there has always been a more or less popular practice of diets and cathartics.

Vaccine therapy, which characterized the bacterial phase, was widely employed following reports of its successful use in 1909 by Fleming[1] in England and in 1910 by Engman[2] in America. That occasional good or even brilliant results did occur cannot be denied, yet the therapy of acne with bacterial products, in the light of our present knowledge, is reserved for the selected case of pustular type in which staphylococcus toxoid may be indicated as an aid. The peak of enthusiasm for vaccine therapy seems to have been reached about 1914, when its external use[3] was reported to have produced good results. As long ago as 1923, Fox[4] reported on the failure of vaccine therapy. Informed opinion today is agreed on this fact, yet the yearly sale of acne vaccine throughout the United States is still of large proportion. Fifteen manufacturers are licensed to prepare acne vaccine. It is still listed in trade catalogues and advertised to the profession.

X-rays and ultraviolet rays are the mechanical devices which have played an important role in therapy. Having reached the stage of realism, x-rays have proven themselves, when competently administered, the most useful single agent in the treatment of this disease. It is our opinion that this position will continue to be maintained.

Ultraviolet rays, in spite of their limitation, are important adjuvants to treatment.

Puberty and menstruation are frequently accompanied by acne or acneform eruptions. Acne vulgaris, except in rare cases, does not appear before puberty; it runs a gradually diminishing course through adolescence, interrupted at times by periodic exacerbations. The premenstrual or menstrual flare has caused much concern. It seemed to link acne with menstruation, therefore, with the endocrine glands associated with the production of estrus. The disease tends to die out completely as age advances. Considering the association of the symptoms with these physiologic states, it was to be expected that the hormonal phase of acne therapy should follow in a natural sequence.

Some sixteen years ago, Hollander[5] and later Schamberg[6] noted this relation of acne to puberty and the menstrual cycle. In the same year, Pick[7] reported the treatment of 17 acne cases with injections and oral administration of gonadal extracts. He obtained excellent results in 8 cases that had associated rosacea. For the next ten years, comparatively little was written on the subject. In 1931 Bloch[8] published his notable work on correlation of acne to the endocrine system. In the same year, Cunningham and Luntsford[9] examined over 5,000 women college students, over half of whom had acne. They found no difference between those with acne and those free of acne in (1) incidence of constipation, (2) incidence of colds or condition of nose and throat, (3) nutrition, and (4) menstrual characteristics such as age of onset, duration, irregularity in interval, and dysmenorrhea.

In the investigation of the estrogenic activities during the menstrual phase, several investigators[10 11 12 13] reported independently that the normal female excretes 10 to 20 units of estrogenic substance per liter of urine throughout the menstrual period. It was also found that almost all normal females have 14 mouse units of estrogenic substance per 40 c. c. of blood during the ten days premenstrually. Taking the above as normal, Rosenthal[14] obtained a negative reaction for estrogenic substance in the blood of 93 per cent of 29 females with acne. His reports from the use of estrogenic substance in the treatment of acne showed 34 per cent definitely improved. This and the conclusions reached by Lawrence[15] in regard to the clinical effects of the anterior pituitary-like hormone created much enthusiasm on the part of some who have occasion to see patients with acne vulgaris. Dermatologists, for the most part, maintained an attitude of scepticism. Schooled in

*Read in Section on Dermatology and Syphilology, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

*From the Department of Dermatology of the St. Louis University School of Medicine and the Dermatological Service of the St. Louis City Hospital.

the vagaries of past therapeutic fancies, new cures unless accompanied by substantial evidence, are slow to be accepted by trained observers.

The administration of anterior pituitary-like substance was followed by the use of theelin. This in turn led to the use of the vitamin present in wheat germ oil which is alleged to be a stimulent of the pituitary body.

In the past several years, much work has been done on the absorption of hormones through the skin. Zondek,[29] in 1935, proved that estrone was absorbed from inunctions. Jadassohn,[30] in the past year, published several papers on the percutaneous absorption of various sex hormones. He showed that the local application of nine different sex hormones to the nipples of male guinea pigs caused an enlargement of the treated nipple. In the case of two of these hormones, a hematogenous effect was also present. No doubt, we will soon be able to administer various hormones through the percutaneous route. However, until their exact effect, both locally and systemically, is known, we must advise against their use except under careful supervision.

McCarthy and Hunter,[16] by the use of the Frank and Goldberger tests, were able to show, in a series of 72 patients with well developed acne vulgaris, that 41 per cent of the males and 78 per cent of the females showed a deficiency of the anterior lobe of the pituitary or of the gonads. Eight per cent of the males and 7 per cent of the females exhibited a deficiency in the function of both glands. Of the 60 females, only 30 per cent had any history of menstrual disturbances, although 78 per cent of the total showed an endocrine deficiency. However, as a result of treatment of these patients with gonadotropic substance and theelin, they concluded glandular therapy of acne vulgaris was of no value except in recurrent papulo-pustular types which have had a sufficient amount of x-ray radiation.

Later, Williams and Nomland[17] found only a 7 per cent greater improvement in patients receiving injections of gonadotropic substance over controls who received sterile water injections.

In the past, Pighini and Santoni,[18] Lawrence,[19] Van Studdiford[20] and others have reported upon the treatment of acne with glandular products. These reports have revealed two important findings. First, those articles reporting excellent results and praising glandular extracts highly are based on a maximum of 10 cases. Whenever an author has treated a large series of cases we find that this enthusiasm decreases in direct proportion to the number of cases treated. In the second place, we find that those cases which have responded best to hormone therapy are usually those with associated menstrual difficulties, and the improvement in the acne paralleled the improvement in these menstrual dyscrasias. Thus we see that the attempts of a monotherapeutic treatment for acne are found inadequate in the final analysis. The reason is fairly obvious when we consider the many factors that enter into its etiology.

Experience has led us to believe with Stokes and King[21] that heredity is responsible for a predisposition to acne. It cannot be denied that acne is a familial disease. Eighty per cent of the patients in our series of 35 had one or both parents who have had acne or had brothers or sisters who have or have had the disease. It is not that acne is hereditary but rather the necessary physiological background for acne is inherited.

With the development of secondary sex characteristics the skin itself undergoes a profound change. The smooth, thin, infantile skin becomes thick and studded with visible follicles. The normal adult skin replaces the skin of childhood. It is the same influence which brings about the development of primary and secondary sex characteristics that usually causes the activity of the cells of the sebaceous glands and also stimulates the pilosebaceous apparatus to hyperkeratinization. The alteration of the follicle lining impairs the even flow of sebum; a comedone is the result. Bacteria of acne, implanted in a suitable media for growth, are locked in the follicle. The comedone-plugged sebaceous cysts slowly dilate without inflammatory reaction. Suddenly groups of these comedone cysts become inflamed papulo-pustules.

The periodic almost rhythmic crops of acute papulo-pustules have excited much conjecture. The outcropping of new, inflamed lesions in early adolescence is so rapid that they appear to be constant; it is only as the disease quiets down that the periodicity becomes striking. The premenstrual or menstrual flare is encountered in many females, yet by careful questioning and observation we found in a series of 27 females that 8 were definitely worse near the ovulation period. Fifty-one per cent were unable to notice definite exacerbations at any time.

The completion of that period which we call adolescence may be delayed for years. Normal development of secondary sex characteristics follows the response to stimulation of the epi-

dermal layer and its appendages. In a few, the full flower of sexual maturity, in its broadest sense, does not occur. Without considering the frankly pathological, there is abundant evidence of incomplete maturity of the endocrine functions or of the altered balance which produces physical signs that are different from the normal or average. If, then, the normal adolescent has an oily skin and develops acne, the acne-free dry skin must be considered abnormal. Interest is at once directed toward the mechanism by which the pathology of acne occurs in a normal, oily skin.

Our opinion is shared in part by Sharlit,[22] who says that the organism elaborates at puberty an unknown substance or substances that operate, on the one hand, to influence the sex organs and, on the other, the pilosebaceous apparatus (a secondary sex factor). With the throwing into the circulation of this pilosebaceous "stimulant," acne appears.

The adrenal cortex influences the development of the genital organs and secondary sex characteristics, notably the growth of hair (Zondek[23]). Hypertrichosis follows hyperadrenalism. Puberty praecox, with its associate infantile acne, is accompanied by tumors and excess secretion of the adrenal cortex. Zondek likewise is of the opinion that secondary sex characteristics, as indicated in pseudo-hermaphroditism, are independent of the gonads. Just as in other abnormal endocrine reactions, the skin because of an inherited predisposition, may respond in an abnormal manner (hyperkeratosis) to a hormone which is excreted in a normal quality and quantity.

Complex as the endocrine substance may be, and though interreaction of glands be necessary, the evidence points strongly to the fact that some component of the secretion of the adrenal cortex is the stimulant which lights the fire of acne.

As an added factor, the presence of seborrhea invites infection with the acne bacillus and the staphylococcus. The comedone forms and acne develops. It should be noted that not all who have seborrhea develop acne, but it is significant that those who do not have some seborrhea do not have acne. Ketron[24] is of the opinion that the primary cause of the disease is bacterial. He also believes that whether or not the follicular orifice becomes blocked depends upon the rate of sebaceous flow and on the rapidity of bacterial growth. While we are not wholly in accord with this view, we believe that the secondary presence and growth of bacteria are necessary for the development of the characteristic lesion of acne.

The explanation of the rhythmic exacerbations of acne, which we have previously noted, may rest in the activity of the reticulo-endothelial system and the lymphatic drainage of the skin. In an attempt to determine the mechanism of this genito-dermal relationship, we investigated the rate of absorption of intradermally injected dyes during the various phases of menstruation. In these experiments, it was our intention to determine any variations in cutaneous activity during the menstrual cycle as evidenced by the rate of absorption of the dye. The technique was carried out according to the method of Leszczynski[25] on patients in the gynecological division of the St. Louis City Hospital. Most of these patients were hospitalized for acute gonorrheal salpingitis. At the time of the testing, they were free of fever and ready to be discharged. Others, included one each of lymphogranuloma inguinale, twisted ovarian cyst, drained pelvic abscess, six-day postoperative ectopic pregnancy and two cases of perineal laceration awaiting operative repair.

At first, 1 per cent methylene blue was used, but later 1:5000 trypan blue was substituted because the intradermal injection of methylene blue was not only exceedingly painful, but also caused an urticarial reaction around the site of injection. Trypan blue was found to be practically free of this second objection.

The procedure followed was to lightly wipe the skin with 70 per cent alcohol which was permitted to dry without rubbing. A 27 gauge hypodermic needle was used and 1/20 c. c. of sterile solution slowly injected intradermally. The result was a slightly raised, rounded, dark blue papule measuring one-eighth to three-sixteenths inches across. If the first papule was not satisfactory, a second one was made several inches away or on the other forearm.

Readings were made at twenty-four-hour intervals and the amount of dye absorbed estimated roughly in figures of 25, 50, 75, 90 and 99 per cent.

Though we have had the opportunity to run only fifty-five cases, we feel that our preliminary findings are sufficiently interesting and coordinated to warrant their report.

We found that in the premenstrual period of one to six days there is a definite decrease in the rate of absorption of the dye. During menstruation the rate began to rise and in the resting and interval phases the greatest rate of absorp-

tion was found. It was also noticed that in acne cases there was a marked decrease in the rate of absorption during the entire cycle. This decrease in absorption was not found in other skin conditions, although several cases of secondary syphilis, impetigo, pruritus hiemalis, rosacea and scabies were in the reported series.

Leszczynski[25] reported the greatest absorption during the menstrual period, while our results showed the greatest absorption in the ovulation period. Our findings are thus more in line with the occurrence of pustules on the faces of many women in the premenstrual period.

Leszczynski[25] states that the absorption of dye from intracutaneous papules is dependent upon the activity of the skin reticulo-endothelial system. His contentions are borne out by the work of Kwistkowski.[26] Should this explanation be accepted, our preliminary findings, when substantiated by further effort, suggest this postulation. The rhythmic exacerbation of acne is based on a periodic decreased activity of the skin reticulo-endothelial system.

In reviewing our discussion of the acne problem there appears to be six important factors: namely, (1) there is an hereditary predisposition to acne, (2) there is hyperstimulation of the pilosebaceous apparatus probably brought about by some unknown substance which appears with puberty and gradually diminishes as age advances, (3) an excess of sebum occurs, (4) there is a bacterial invasion of the sebaceous follicle, (5) hyperkeratosis of the epidermis develops, and (6) there is an indication of a decreased activity of the reticulo-endothelial system of the skin.

From the foregoing facts and in the light of our present knowledge and experience there is no logical reason to attempt short cuts in treatment. No prophylactic is available. Endocrine and vaccine therapy have proven useless except in selected cases. The former because of tube blocking[27] and carcinogenic possibilities may prove dangerous. Tin and manganese, because of the reputed beneficial results in certain pyogenic infections, have been recommended for acne vulgaris. The authors have had no experience with the use of these metals and, therefore, cannot voice an opinion. It would seem from the number of failures encountered, that these substances are not as successful as their purveyors would have us believe. Over and above this fact, inorganic metal is an irritant to the organism and colloidal metals have not been proven harmless.

The most satisfactory approach to rational therapy is based on the assumption that each case be treated individually. A quick cure in young patients, except when disfiguring scars may occur, is not essential. The relations of the patient and physician are enhanced if there is an understanding that the juvenile phase of the disease must be managed until a cure can be brought about. This presupposes that x-ray will be used sparingly or not at all until the eighteenth year. This plan, which is essentially the same as that recommended by Michael,[28] has been in use by one of us for a number of years and has proven to be most satisfactory. The x-ray, after a thorough trial with general and local methods and when conservatively used, is a most effective and satisfactory agent in this disease. Dermatological methods, with modifications as indicated, are well adapted to topical treatment.

Organic disease, regardless of the age of the patient, should be corrected. Diet if well balanced need not be disturbed except to omit the main halogen containing foods and drugs which sometimes tend to aggravate an existing condition. There is no proof of the evil effect of carbohydrates or fats on acne. It is our opinion that the growing youth needs these high caloric foods and should not be deprived of them. The stools, if too infrequent, should be regulated by diet and habit. Cathartics serve no useful purpose.

In conclusion, it may be said that a quick, certain and safe treatment does not exist. This most common of all dermatoses is too frequently mistreated by slight consideration or overtreated with drugs and methods which are ineffective and dangerous. The middle course of conservatism and intelligent management, though arduous, is ultimately more satisfactory to the patient and physician.

REFERENCES

1. Fleming, Alexander: On the Etiology of Acne Vulgaris and Treatment with Vaccines. Lancet, p. 1035 (April 10) 1909.
2. Engman, M. F.: Bacteriology in Certain Diseases of the Skin. Jour. Cutan. Dis., p. 553, 1910.
3. Towle, H. P.: External Vaccine Therapy. Jour. Cutan. Dis., p. 770. 1914.
4. Fox, Howard: The Roentgen Ray versus Vaccines in the Treatment of Acne. J.A.M.A., **81**:1417 (Oct. 27) 1923.
5. Hollander, L.: The Role of Endocrine Glands in the Etiology and Treatment of Acne: Preliminary Report. Arch. Dermat. & Syph., **3**:593 (May) 1921.
6. Schamberg, J. F.: Research Problems in Dermatology. Arch. Dermat. & Syph., **4**:293 (Sept.) 1921.
7. Pick, W.: Acne and Internal Secretion. Arch. Dermat. & Syph., **131**:350, 1921.
8. Bloch, B.: Metabolism, Endocrine Glands and Skin Diseases, with Special Reference to Acne Vulgaris and Xanthoma. British Jour. Dermat. & Syph., **43**:61 (Feb.) 1931.
9. Cunningham, R. L.; and Luntsford, C. J.: Acne: Statistical Study of Possible Related Causes. California & West. Med., **35**:22, 1931.
10. Rosenthal. Theodore: Acne and Its Relation to the Endocrines. The Journal-Lancet, **56**:496 (Sept.) 1936.

11. Kurzrok, R.; and Ratner, S.: Relation of Amenorrhea Accompanied by Genital Hypoplasia to Follicular Hormone in Urine. Amer. Jour. Obst. & Gyn., **23**:689, 1932.
12. Frank, R. T.; and Goldberger, M. A.: Clinical Data Obtained with Female Sex Hormone Blood Test. J.A.M.A., **90**:106 (Jan. 14) 1928.
13. Mazer, C.; and Goldstein, L.: Clinical Endocrinology of the Female, p. 165. Philadelphia: W. B. Saunders Co., 1932.
14. Rosenthal, Theodore: Therapy of Acne Vulgaris with Hormone Preparations. New York State Med. Jour., **37**:244 (Feb.) 1937.
15. Lawrence, Chas. H.: The Anterior Pituitary-Like Hormone: A Clinical Study of Its Effects in Acne Vulgaris. J.A.M.A., **106**:983 (March 21) 1936.
16. McCarthy, Lee; and Hunter, Oscar B.: Failure of Therapy with Glandular Preparations in Acne Vulgaris. Arch. Dermat. & Syph., **35**:211 (Feb.) 1937.
17. Williams, Grace E.; and Nomland, Ruben: Gonadotropic Substance in the Treatment of Acne. J.A.M.A. (Aug.) 1937.
18. Pighini, G.; and Santoni, L.: Anterior Hypophysis and Skin. Gior. ital. di dermat. e sif., **76**:1393 (Dec.) 1935.
19. Lawrence, C. H.: Anterior Pituitary-Like Hormone: Clinical Study of Its Effects in Acne Vulgaris. J.A.M.A., **106**:983, 1936.
20. Van Studdiford, M. T.: Effect of Hormones of the Sex Glands on Acne. Arch. Dermat. & Syph., **31**:333 (March) 1935.
21. Stokes, J. H.; and King, A. D.: Acne Vulgaris: Heredity in the Etiologic Background. Arch. Dermat. & Syph., **26**:456 (Sept.) 1932.
22. Sharlit, Herman: Discussion of paper by Sulzberger, M. B.; Rostenberg, Jr., Adolph; and Sher, J. J.: Acneform Eruptions: With Remarks on Acne Vulgaris and Its Pathogenesis. N. Y. State Jour. Med., **34**:21 (Nov.) 1934.
23. Zondek, Herman: The Diseases of the Endocrine Glands. Wm. Wood & Co., 1935.
24. Ketron, L. W.: Discussion of paper by McCarthy, Lee, and Hunter, O. B.: Failure of Therapy with Glandular Preparations in Acne Vulgaris. Arch. Dermat. & Syph., **35**:224 (Feb.) 1937.
25. Leszczynski, Roman: Reciprocal Relationships Between the Skin and the Female Genital Organs. Delib. Cong. Dermat. Int., **9**:62, 1935.
26. Kwistkowski, S. L.: Untersuchungen Uber Das Reticulo-Endotheliale System der Haut. Arch. fur Dermat. und Syph., **171**:440, 1935.
27. Whitney, Rae; and Burdick, H. O.: Tube-Locking of Ova by Oestrogenic Substance. Endocrinology, **20**:643 (Sept.) 1936.
28. Michael, J. C.: Observations on the Treatment of Acne Vulgaris. J.A.M.A., **105**:327 (Aug.) 1935.
29. Zondek, H.: Hormone des Ovariums und des Hypophysenvorderlappens. Springer, Wien, 1935.
30. Jadassohn, W.; Uehlinger, E.; and Margot, A.: The Nipple Test: Studies in the Local and Systemic Effects on Topical Application of Various Sex Hormones. Jour. Invest. Derm., **1**:31 (Feb.) 1938.

DISCUSSION (*Abstract*)

Dr. Thomas W. Murrell, Richmond, Va.—This paper gives an experimental reason why acne is accentuated at the menstrual period. That acne is worse at the menstrual period is a statement so frequently made by the patients themselves and observed by clinicians, as not to be a matter for argument. The title of the paper is very broad in its implications and one is justified in discussing it from many angles.

My greatest difficulty is in getting the family of the adolescent to realize the necessity of continuous and thorough treatment. This arises from the fact that due to folklore and quack advertising the average person feels that acne should be corrected in some simple and quick fashion. When this is not forthcoming, they feel that it is ineradicable and must be borne with fortitude. If the mother can bring the patient to the physician in the same frame of mind she would call for help in pneumonia or appendicitis, much can be accomplished to make treatment worth while.

There is a statement to which exception can be taken, and that is that x-ray should be used sparingly, or not at all until the eighteenth year. We see boys and girls of 18, who are still immature, and again we see youths of 16 who have reached a rapid maturity. And so it is the evidence of maturity rather than the calendar age which should be a deciding point.

Further, if the acne is of the indurated type and much scarring will result, so much damage can be done between 15 and 18 that if we wait until 18 there is little reason for using it at all, for the worst effect of acne, namely scarring, will be accomplished.

There is hearty agreement with the ideas about diet in these cases. The use of cod liver oil, reinforced with vitamins and hematinics, has proven of undoubted benefit even in cases actually tending to overweight.

Particularly with the girl exhausted by social affairs and avoiding fattening foods, such a treatment is an absolute necessity.

These statements merely confirm the opinion expressed by the authors of the paper, to-wit: the rational treatment of acne is the proper treatment of the individual case.

Dr. D. Truett Gandy, Houston, Texas—Acne, in its mildest form, is so common in adolescence of both sexes that it must be considered almost physiologic.

Yet treatment of the mild cases will often prevent development of the more severe types.

In the management of any case of acne it is imperative that the physician have the full cooperation of the patient, and in the juvenile cases, that of the family as well.

A broad, but nevertheless important item, is the general health of the patient.

Of all the general contributing factors, gastro-intestinal dysfunction is perhaps the most important. Faulty bowel function should be remedied, and this applies particularly to constipation.

A secondary anemia is present in many cases, and often makes them more recalcitrant to treatment. For some time I have made it a practice to look for this factor whenever possible, and where found the condition is rectified by appropriate treatment.

After going carefully over Dr. Stryker's paper, I found nothing with which I could disagree except his attitude toward diet, and I feel that on that point I must differ with him. While admitting that there is no real scientific evidence on which to base such an opinion, and I may say, parenthetically, that I doubt whether the laboratory has spoken the last word, yet I cannot close my eyes to what clinical experience teaches me, namely, that exacerbations are frequent when the patient indulges too freely in carbohydrates. It may be that this evil effect is due not so much to the actual high total carbohydrate intake, but rather to a raising of the allergic threshold to certain specific items in the carbohydrate diet. But I think it unquestionable that at least in individual cases an excessive intake of carbohydrates is provocative of new outbreaks, and I can recall many instances where the violation of the dietary regimen has been followed by relapse in a seemingly cured patient. In my experience, a diet must be absolutely adhered to for from 6 to 12 months, and relatively closely followed indefinitely.

Practically every patient with acne also has dandruff, and unless proper attention is paid to this the acne response will not be the best possible. Even frank seborrheic dermatitis of the scalp accompanies many acnes, and must be treated for permanent results. In my experience, recurrences on forehead and along the hairline are especially associated with the scalp.

On listening to this paper, one is struck by the fact that there exists as yet no definite and rationalized approach to the endocrine factor.

Although there is still room for improvement, I think that our treatment of acne has in recent years gained much in efficiency.

Dr. Leo N. Elson, New Orleans, La.—I think that acne is not a separate disease entity but embraces a vast class of diseases grouped under the name of acne. While one thing is sure about the etiology of all these forms of acne, namely that they occur in the period of puberty coinciding with the period of development of secondary sex characteristics, when hypertrophy of the skin appendages is most noted, to ripe adolescence, yet there are many contributing factors that modify and influence the course and nature of the disease. One of the greatest contributing factors is, in my opinion, the enormous consumption of sugar, in comparison with the consumption of fifty or sixty years ago. I have in mind the form of pustular acne. In many respects there is a great analogy between pustular acne and diabetic furunculosis and the staphylococcus plays, in both, the major role in the etiology and chronicity. This parasite thrives on a medium containing sugar, and when the blood is oversaturated with sugar, hyperglycemic, the sugar is bound to be secreted in the sweat and other skin secretions, causing a hyperglycidria (or hyperglycosudoria), which perpetuates the growth of the parasite. I think, therefore, that in a rational therapy of pustular acne, the consumption of sugar must be, among other measures, restricted to a minimum to obtain results from any chosen form of treatment. Permit me to relate an anecdote originated by me long ago: when patients ask me why they are singled out to suffer from acne, I tell them that nature goes by a law of averages. Five per cent of the young population must suffer from acne and if these five per cent are killed off another five per cent of the population will have to assume their role.

Dr. Stryker (closing).—It was our statement that the x-ray should be used sparingly or not at all before the eighteenth year. This, of course, admits the necessity of administering x-ray under the conditions which Dr. Murrell mentioned. At the same time I feel it unwise to recommend its use at an earlier age because of the possibility that this recommendation might be interpreted as a rule to be applied to all cases.

Dr. Gandy's statement in regard to exacerbations accompanying carbohydrate indulgences is true to a certain extent. Nevertheless it has been my experience that these carbohydrate excesses are usually accompanied by the ingestion of large quantities of chocolate which might, on account of the iodine content, accelerate a flare-up.

The same explanation might be given for Dr. Elson's remarks in regard to the concentration of sugar in the blood, sweat and secretions. I have always felt that during puberty, when there is marked physical and physiologic activity, any excess in carbohydrate consumed is, under normal conditions, readily oxidized by the tissues. The rate of metabolic activity which exists in a maturing, active, young adult is probably the reason for the sugar hunger which frequently exists in these children.

THE MANAGEMENT OF COMPOUND FRACTURES*

By GUY A. CALDWELL, M.D.
New Orleans, Louisiana

Progress in the management of severe, compound fractures has not been so rapid as in the treatment of simple fractures. In fact, very little change has been recorded since the World War. There has been a considerable number of published articles on different phases of treatment and a few textbooks have given careful consideration to the guiding principles. There have been, however, too few reports of end results, length of hospital treatment, period of total disability and residual partial impairment of function as related to specific methods of treatment.

In this brief commentary I shall outline the present status of the treatment of compound fractures and review critically some of the suggested measures. Only the severer types of infected and contaminated cases will be considered.

Examination of the patient who has recently incurred a compound fracture should be from the viewpont of the treatment indicated. First thought should be given to the individual's age, general condition and the degree of shock and hemorrhage present. Children under 6, adults over sixty and those who have been greatly debilitated by disease or malnutrition should be subjected to only the simplest and shortest of operative procedures and then only after shock and hemorrhage have been effectively overcome. If there be any reasonable fear of soil contamination of the wound, at least 1,500 units of antitetanic serum with 1,000 units of the polyvalent perfringens antitoxin should be given as a prophylactic measure. While it has been proven that the perfringens antitoxin is a valuable adjunct in the prevention of gas gangrene, it in no way replaces surgical measures that should be used, nor is the certainty of its preventive effect comparable to that of antitetanic serum.

Shock of dangerous degree is indicated by a systolic blood pressure below 80 mm.[8] Measures for combating it are (1) morphia, (2) elevation of the foot of the bed or stretcher, (3) first aid dressing of the wound, (4) infiltration about the wound edges and the site of fracture

*Chairman's Address, Section on Bone and Joint Surgery, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

with 0.5 to 1 per cent procaine hydrochloride, (5) temporary immobilization of the fracture, and (6) hot blankets and hot water bottles. Hemorrhage must be controlled as promptly as possible. If a tourniquet has been applied, it should be released and the bleeding vessels clamped, even if it be necessary to open the wound. An infusion of 100 to 200 c. c. of blood or saline should then be given. Roentgenologic examination of the fractures in the badly shocked patient can well be postponed until he has rallied.

Every effort should be made to learn from the patient or witnesses just where and how the accident occurred and other facts pertaining to the possibility of soil contamination of the wound. A very greasy, dirty looking laceration which occurred in a machine shop is less likely to contain tetanus or gas bacilli than one which was inflicted on the highway or in a cultivated field. Mine workers, although subject to the worst crushing injuries, appear to develop gas gangrene but rarely. Desert sands and rocks from the higher altitudes seldom harbor the more dangerous germs. When one of the protruding fragments has penetrated muddy or badly soiled clothing, it is probable that any or all of the worst organisms have been carried back into the tissues.

Swelling, ecchymosis, impairment of circulation and comminution of the bone give some idea of the extent of tissue damage and additional information may be elicited from the history. Fractures produced by blunt instruments, soft lead bullets, jagged shell fragments and direct blows or crushing injuries are accompanied by severe injury of the soft parts and are likely to be contaminated with bacteria.[1] The most dangerous wounds seen in civil practice are those inflicted by a shotgun at close range. The massive load of small shot produces much death of tissue, carries into the wound numerous bits of clothing and is always accompanied by the shell wadding which invariably contains the spores of tetanus and gas bacilli.

No operative procedure should be carried out until the pulse rate has diminished and the systolic blood pressure has become higher. Roentgen examination can then be made, preferably with a portable or bedside unit, and if this moving of the patient does not affect the pulse rate and blood pressure, operation may be undertaken.

Consideration should next be given to the length of time that has elapsed since the injury occurred. This should be estimated from the time of accident to the hour when operation will be begun. The elapsed time, age and general condition of the patient, together with the extent of injury, will govern the type of anesthetic and operative procedure to be undertaken. After six hours with extensive tissue damage and after twelve hours with slight or moderate injury, bacteria have gained sufficient foothold in the wound for it to be regarded as infected and treated accordingly.

When the patient is on the operating table, the preparation of the wound and field of operation must be decided. The procedures recommended vary from an elaborate shaving, scrubbing and rinsing with gallons of soapy water followed by alcohol and ether[8] to the simple application of a little iodine to the undisturbed dirt, hair and skin in the immediate vicinity of the wound.[9] While the first method is more commonly used, the latter is probably more logical and certainly is less sloppy.

The nature of the operation about to be undertaken is variously described by the terms toilet, or excision of the wound and debridement. By whatever phrase it is designated, the procedure should be understood to include more than a simple excision of the skin edges. An excellent definition has been given by Wilson and Cochrane:[7]

> "The operation is a delicate, painstaking dissection of all the contaminated and damaged tissue and necessitates complete exposure and careful exploration of all parts of the wound."

In the proper doing of it, dead and dying skin, subcutaneous tissue, fascia and muscle will be removed by sharp dissection, soiled bone edges will be cut away, bleeding will be controlled and all foreign material removed. The use of irrigation in the wound is recommended by many able men and condemned by others. The surgeon who obtains a good exposure of the entire field of injured tissues and is expert in his dissection will probably come nearer removing all foreign material than the one who makes a small incision and relies on irrigations and antiseptics for wound cleansing.

The soft tissues having been adequately cared for, the next problem concerns the bone fragments. There is general agreement that entirely detached fragments should be lifted out and discarded while those with periosteal attachments should be left *in situ*. Reduction of the fracture by introducing instruments into the wound is opposed by some surgeons.[9] In the severe

cases the exposure required for a debridement is so great that the fragments may be readily grasped with bone holding forceps and a reduction of transverse or notched fractures can and should be accomplished with no additional trauma. Justifiable objection may be made to the use of instruments for the application of multiple screws, plates or bands for internal fixation of comminuted fractures.

Although the use of any means of internal fixation is generally condemned, Sherman and his associates have employed plates and screws in selected cases of compound fractures to good advantage.[4] It is granted by all that this should never be done in frankly infected fractures more than eighteen hours old, nor should it be attempted with compound, comminuted fractures, no matter how early they may be operated upon. When an oblique fracture reaches the operating table within six hours and the necessary instruments are at hand for inserting one or two screws to maintain apposition, there can be no serious objection to their use.[3] However, oblique fragments can usually be locked with only one-fourth to one-half inch shortening by notching them with small rongeur forceps and fitting each projecting end into the marrow cavity of the opposite fragment, and this procedure is preferable to the use of plates or screws.

Having performed the necessary toilet of the soft parts and reduced the fracture, the surgeon's next decision is whether to suture the wound or leave it open. Badly contused and contaminated wounds and those more than six or eight hours old should give rise to no question whatever.[7] All these should be left wide open. If, because of exposed, subcutaneous bone, it seems wiser to approximate the skin directly over it, adequate openings down to the site of fracture must be provided elsewhere, not simple stab wounds with a tube in each, but slits several inches long with separation of the muscles sufficient to permit free drainage, prevent marked swelling and admit oxygen to the deeper tissues.

In cases operated upon less than six hours after injury, it would be ideal to suture the wound and thereby obtain primary healing. Before doing this, however, the surgeon should weigh carefully the dangers attendant upon closure. The greatest risk is not the possibility of abscess formation or ascending infection, but the development of gas gangrene.[2,5]

If the history and appearance of the skin about the wound make it probable that there has been direct or indirect soil contamination, or, if shell wadding and bits of clothing have been recovered in the course of the debridement, gas bacilli and tetanus spores have doubtless been implanted. These are obligatory anaerobes which thrive and multiply in blood clot and dead muscular tissue. To shut the wound tightly is to cut off the oxygen, increase the swelling, diminish the blood supply to the parts and in every way to increase an ideal environment for the development of gas gangrene. Loose suturing, the insertion of rubber tubes through stab incisions or rubber tissue drains between the wound edges do not meet the indications. Sealed, anaerobic pockets in the deeper parts frequently form in spite of such drainage and the gas infection thus gains a foothold. If, on the other hand, the wound is left wide open to the air, the abundant culture media and numerous spores which may be present do not propagate enough to invade the healthy tissues. The most potent agents with which to combat the development of anaerobic infections are air and a good blood supply to the injured parts. These are infinitely more effective than all the germicides and antiseptics combined. Aeration of the wound surfaces can be had only by leaving the wound open and a good circulation is best maintained by the same measure, together with keeping the injured part elevated. The extremity with a wide open wound seldom swells enough to impede its own blood supply. Properly managed, such wounds nearly always heal by the time the fracture is united and the patient has lost no additional time, although the wound has required more dressings. The net gain, therefore, from obtaining primary healing by suture of the wound is but little and the risk taken is very considerable. A very few surgeons with long experience in operating upon such cases may be warranted in taking the risk connected with suturing the wound.[7] The patient and his limbs would be far safer, however, if the great majority of surgeons would never suture the wound when there is any probability of soil contamination of the muscular layers (*Table 1*).

When the wound is left open following operation, the character of dressing to be used becomes a question. Whatever is put into the wound should be loosely inserted instead of being wedged or tightly packed. If plaster is to be used for external fixation, wet dressings, irrigations or installations of antiseptics should not be employed, for these invariably spill over and soften the splint after a few days. Vaseline gauze laid over the open surfaces and loosely between the edges is the simplest dressing when

Table 1

GAS GANGRENE ASSOCIATED WITH COMPOUND FRACTURES

	Total No. Compound Fractures	Fractures with Soil Contamination	Treated by Debridement and	Gas Gangrene Occurred in	Amputated	Died	Recovered
1934-35	(approx.) 50	19	Suture of wounds	19	19	10	9
1936-37	50	22	Open wounds	0	2	2	20

plaster is to be applied and is usually quite effective.

The kind of splinting to be used for external fixation will depend to a considerable extent upon what the surgeon generally uses with greatest facility. He should employ the splint which, in his hands, will give best immobilization with ready access to the wound. It is generally accepted that the more perfectly the fragments are held in place, the better chance there is for the tissues to localize any infection that may develop. The most secure fixation is probably realized when it is feasible to transfix the fragments above and below the site of fracture with Steinman pins or Kirschner wires and incorporate these in the plaster case. The next most secure immobilization is obtained with well applied plaster,[6] but this form of splinting may not be applicable when the fractures are oblique or comminuted. Suspension and traction must be used in connection with many of the latter cases and are most effective when the pull can be transmitted directly to the bone through a metal pin or wire, suitably placed. Much skill, patience and constant attention to every detail of the apparatus is necessary when traction is employed.

Until the swelling and fever have subsided and the infection has been well localized, the closest supervision is essential. When the debridement has been thoroughly done and the wound left open, there need be but little fear of gas gangrene except in the regions of the hip and shoulder. Pyogenic infections are frequent, but seldom severe or prolonged unless the debridement has been incomplete or the wound partially closed. Chronic osteomyelitis with a persistent sinus is, unfortunately, a common sequel when there is much comminution followed by active infection. Sequestration of the splintered fragments is less common when there is free drainage from the outset, combined with effective immobilization.

The final result depends upon the effectiveness of every step of treatment from the very beginning. Good surgical judgment born of much experience, perfect teamwork from assistants and never-ending persistence on the part of all are required to obtain even fair results with the worst types of compound fractures. While much has been accomplished in reducing the death rate and diminishing the number of amputations in such cases, the periods of total disability are too prolonged and the residual partial impairment too great in the majority of cases. Improved methods of splinting and dressing compound fractures and more general knowledge of the technic of a thorough debridement would do much to increase the number of good results.

SUMMARY

(1) An accurate history and careful inspection of the wounds yield valuable data with regard to probable contamination with anaerobic organism.

(2) No operative procedure should be done until the effects of shock and hemorrhage have been overcome.

(3) The time interval from injury to operation is of great importance.

(4) Thorough debridement demands skill and judgment; it is far more than simple excision of wound margins.

(5) Reduction of the fracture through the wound should be done only in simpler cases.

(6) Internal fixation with screws or plates has a very limited field of application, but is permissible in this field.

(7) Suture of the wound is never altogether safe; it certainly is not essential to recovery and a very few surgeons with ripe experience in compound fracture treatment are the only ones who should venture to close the wounds in selected cases.

(8) Dressings should be loosely inserted.

(9) Splinting is a different problem with every case and the solution must vary with the experience of the surgeon in the use of various splinting methods.

BIBLIOGRAPHY

1. Beekman, F.: The Treatment of Wounds in Compound Fractures of the Long Bones. Surg., Gyn. & Obst., **40**:120-124, 1924.
2. Caldwell, Guy A.: Surgical Measures for the Prevention of Gas Gangrene. The Sou. Surgeon, **5**:141-152, 1936.
3. Carrell, W. B.; and Girard, P. M.: Removable Internal Fixation in Fractures. J.A.M.A., **96**:670-673, 1931.

4. Foster, G. V.: Compound Fractures of the Long Bones, etc. Surg., Gynec. & Obst., **56**:529-538, 1933.
5. Herold, A. A.: Three Cases of Gas Gangrene Infection. N. O. Med. & Surg. Jour., **78**:661-662, 1926.
6. Orr, H. W.; and Thomson, J. E. M.: Maintaining Length and Position in the Treatment of Compound Fractures. J.A.M.A., **83**:1399-1403, 1924.
7. Wilson, P. D.; and Cochrane, W. A.: Fractures and Dislocations. Philadelphia: J. B. Lippincott Co., 1925.
8. Key, J. A.; and Conwell, H. E.: Fractures, Dislocations and Sprains. St. Louis: C. V. Mosby Co., 1934.
9. Bohler, Lorenz: Treatment of Fractures (Groves). Fourth English Edition. Baltimore: William Wood & Co., 1936.

THE PERSIMMON PHYTOBEZOAR*

A REPORT OF THREE CASES

By RICHARD JOSEPH WHITE, M.D.
Fort Worth, Texas

The term bezoar from the Arabian bazahr, badi-zahr the Persian pad-zar, pad (protecting) plus zahr (poison), meaning counter-poison or antidote, denoted originally any of the various concretions found in the alimentary organs of certain ruminants. When it was later discovered that human beings occasionally harbored these foreign bodies the term was broadened to include them. Bezoars were formerly thought to have remarkable medicinal properties, especially as antidotes to poison, and there are many accounts of their being sold for more than their weight in gold and because of their supposed value many substances not true bezoars were fraudulently sold as such. You doubtless have all as small boys listened open-mouthed "in the days when you believed everything," as the cartoonist puts it, to the tales of the "madstone" from the stomach of the white deer which was a sure cure for hydrophobia. I remember being told as a boy about one of these that when applied to the bite of a mad dog would stick closely and gradually turn green and when it finally fell off was sure to have all the poison with it. The varieties most prized have been the oriental bezoar composed chiefly of resinous organic matter arranged in concentric layers about some hard foreign nucleous found in the bezoar goat or gazelle and the German bezoar from the Gemsbok composed of interlacing fibers of hair and organic cementing material. Many bezoars found in animals have been mainly hairs which they have licked off while shedding. That superstition about bezoars still exists is witnessed by an advertisement quoted by Cole from a daily newspaper in Springfield, Missouri, December 7, 1929, which reads, "For Sale. Madstone. Large enough for two."

Hart classified human bezoars as follows:

(1) Trichobezoar or hair ball. These are by far the commonest and many cases have been reported. They are usually found in young girls who have acquired the habit of chewing the ends of their hair or rolling up and swallowing pulled hairs or combings. Many of the cases have been in insane persons.

(2) The trichophytobezoar, which is primarily hair mixed with fibers of vegetable matter.

(3) The shellac concretion found in painters or workers in furniture factories where a strong alcoholic solution of shellac is used as a polish. Adding water precipitates shellac, but when swallowed straight shellac is precipitated in the stomach. These masses may attain a very large size. Hart quotes Hallas as reporting two weighing 1,745 and 2,000 grams, respectively.

(4) The phytobezoar or food ball, so called, consists of skins, seeds and fibers of fruit or vegetable matter such as persimmons, prunes, salsify, celery and food detritus such as starch granules, striated muscle fibers, elastic tissue, fatty acid crystals and squamous epithelium.

Balfour reports a bezoar of bismuth subcarbonate removed from a stomach 23 days after it had been given for x-ray examination and quotes Hamdi's case, cited by Woelffler and Lieblein, of a Turk 50 years old who had been taking large doses of salol for cystitis and came to autopsy. His stomach contained a glistening bezoar of crystallized salol measuring 5x3 cm. Hamdi also mentioned three men who, under the stress of war and the flight from captivity, were forced to live in the open fields for several weeks and ate all manner of coarse roots and vegetables. Each developed digestive disturbances and a palpable epigastric mass and from each a bezoar of coarse fibers was removed. LeRoy Long mentions a mass producing intestinal obstruction composed of comb honey and green corn, and I have recently seen two case reports of obstruction in the ileum from a dried peach swallowed whole.

Hart says Martin told him of a bezoar removed from the stomach of a man who was an inveterate tobacco chewer and thought to consist of tobacco, but this patient was not questioned about persimmons.

Persimmon bezoars are much more frequent than all the other food bezoars combined. Outten, in 1894, reported the first case and not until twenty-eight years later, in 1922, did Peple report the second. Schmeisser, in 1935, found thirty authentic cases in the American literature and reported two of his own to this association. They are compact putty-like masses whose size has varied greatly in different cases and they

*Read in Section on Surgery, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30–December 1-2-3, 1937.

are frequently multiple. Several, including one of my cases, have been small enough to pass through the pylorus and produce obstruction in the small intestine. Some have been the size of a fist and the two cases recently reported by Schmeisser were huge and practically filled the stomach. They are fairly soft and can be moulded or broken up by moderate pressure. They vary in color. The one I removed from the intestine was dark brown, doubtless due to bile staining, and the two stomach cases were greenish black on the surface and pinkish yellow when broken open. The fresher ones in the stomach have usually been described as greenish yellow. Dr. Balfour describes one that was fairly fresh as giving off the "not unpleasant effluvium of fermenting fruit," but the ones I have seen have not had this odor to any degree. Experiments at attempting to dissolve them *in vitro* by pepsin and hydrochloric acid solutions comparable in strength to gastric juice have had no effect. A case is reported from St. Louis by Mills and Simpson in which a patient who had a bezoar demonstrated by x-ray and an anacidity, was given dilute hydrochloric acid and promptly passed prune and raisin skins and raisin stems with disappearance of the bezoar, but I have not been able to find a record of this happening to a persimmon bezoar. There is no exact information as to why they are formed. Certainly a great many people eat persimmons with impunity. Schulze points out that in the histories of most of the reported cases the circumstances under which the persimmons were eaten are important. The majority of the patients were out doors, walking, hunting, fishing or playing golf and were very hungry. They ate ravenously and in great haste of persimmons alone. The relative acidity of the gastric juice is apparently not significant. Neal, in reviewing twenty cases, says that gastric acidity determinations were made in eight of them. In four cases there was hyperacidity, in two achylia gastrica, and in two there were normal values. He says that these analyses are really worthless as they were all made weeks after the bezoars were formed and the original values might well have been altered by their presence. All authors on this subject mention the high percentage of gum (14 per cent) and pectin (7 per cent), the obvious deduction being that this must be a significant factor. Pollok, in discussing Schmeisser's paper, relates a research published in the biochemical section of the *Japanese Journal of Medical Sciences* by Kamatsu. This author stated that a substance he describes as phlobotannin composed of phloroglucin and gallic acid is most abundant in the unripe persimmon of the astringent variety. He broke apart a persimmon bezoar and demonstrated this substance between the fragments of persimmon skins. He immersed gauze bags containing the skin and adjacent flesh of 22 common varieties of fruits and berries in artificial gastric juice and placed them in an incubator. Agglutination of skin fragments into a mass occurred only in the persimmon and this only took a few hours. The common persimmon, *diosporos Virginiana,* occurs in the Southern and Eastern United States, and the Mexican persimmon, *diosporos Texana,* predominantly in Texas and Oklahoma. The fruit is much the same; the chief difference lies in the size and growth of the trees.

Neal says that the effect of a persimmon ball on the stomach is dilatation of the stomach with redness, congestion, edema and in some cases hemorrhage and ulceration. Ulcers were present in 7 of the 20 cases he reviewed.

The symptoms are usually those of a very severe gastro-enteritis with vomiting, cramping pain, purging and fever. The acute symptoms ordinarily gradually subside and there is a slow return towards normal, but some symptoms continue. There may be only a sense of weight and fullness in the abdomen. Eating, in some instances, has apparently relieved discomfort and in others increased it. Severe nausea is frequent. There is sometimes vomiting, but this is usually not marked and as Maes points out, commonly mucoid or watery, as the bezoar acts as a ball valve in the cardiac end of the stomach and prevents complete ejection of stomach contents; acute pain may result from pyloric obstruction, spasm of a segment of stomach on the foreign body or ulceration of the stomach. The colicky pain of intestinal obstruction may result when the foreign body has slipped into the intestine. Several cases have reported, apparently of long standing, that have shown a surprisingly good general condition and relatively little loss of weight. In a fair number of the reported cases that have had extreme symptoms, diarrhea with alternating constipation, foul breath, offensive stools and inanition have developed and the picture has closely resembled malignancy. Severe hematemesis as a symptom of phytobezoar has been but rarely noted. Smith reports two such cases. One of them at operation showed only edema and congestion of the stomach mucosa. Another, with massive hemorrhage, showed three

bezoars and a large ulcer which had perforated into the pancreas and gave the appearance of an advanced cancer. The patient had some discomfort 27 months after the removal of the bezoar, but roentgenologically the ulcer could not be demonstrated. He says that hemorrhage with a bezoar has been diagnosed roentgenologically as an inoperable malignancy and in case of doubt exploration should always be done.

The association of ulcer with bezoar is evidently much more frequent. It was present in two of the cases I am to report and it is rather surprising that more frequent bleeding from these ulcers has not been encountered. The ulceration, it is reasonable to believe, is traumatic; and, except in Balfour's case, in which he thought that the ulcer preceded the bezoar and did a resection, I can find no report of radical surgery for ulcer. They have apparently usually healed when the bezoar was removed.

The x-ray findings are of great interest. Movable filling defects in the stomach are the outstanding observation. Sometimes thin streams of barium can be seen flowing around the margins of these defects and the peristalsis in the adjacent stomach walls is normal. A very distinctive finding in one of the stomach cases I have to present was the adherence of flecks of barium to the foreign bodies which made them clearly visible as "ghosts" in the six-hour plates.

It seems incredible, but these tumors have been diagnosed as floating kidney, movable spleen, gastric polyp, adenoma and carcinoma of the stomach, cholelithiasis, encapsulated foreign bodies, fecal impactions in the transverse colon, omental tumors, hydatid cysts and twin pregnancies. It is likely that in remote country districts where persimmons are common and doctors are few, there are probably numbers of people with chronic stomach complaints carrying persimmon bezoars. Hart, in Decatur, Illinois, and Murdock in Tulsa, Oklahoma, were each able to collect several cases from their communities after they became conscious of the condition.

The treatment is obvious, and has usually yielded brilliant results. Surgical removal by gastrotomy or enterotomy should be done at once. Maes says Dr. Matas reported the operative mortality in 1912 on 47 bezoars of all varieties as 4 per cent. It surely ought to be lower now. Moersch and Walters relate a case in which a patient had a bezoar demonstrated by x-ray and at operation a gastric ulcer was found but no bezoar. The symptoms promptly recurred and a second x-ray again demonstrated the bezoar. The patient was dubious until it was seen through a gastroscope and removed. This is an extreme example, but is a warning which should be heeded. The incision in the stomach should be large enough to put the hand in to prevent overlooking one or more bezoars in the fundus when they are multiple.

I have three cases of persimmon bezoar to report, two of them my own and one through the courtesy of Drs. K. H. and F. C. Beall.

Case 1 (Hospital No. 87).—A. G. G., a white man of 48, married, was admitted to St. Joseph's Hospital January 8, 1937. His complaints were: (1) pain in the stomach; (2) vomiting; (3) loss of appetite; (4) loss of weight; (5) tasting persimmons.

On Christmas Eve, 1936, he ate a great many ripe persimmons, including the skins, but not the seeds. Since a few hours after that he had been miserable with cramps in his stomach and vomiting. His appetite had been very poor and he had lost considerable weight and felt weak. He had pain high in his epigastrium, which was dull and constant with acute exacerbations. The pain did not radiate. He actually vomited very little, though he was nauseated a great deal and retched frequently. In September, 1935, he went to Longview, Texas, and for the first time in thirty years ate freely of persimmons. He had an attack similar to the present one except that it lasted only three days. In August, 1936, he was in El Paso, ate some baked fish and had a bowel upset, which lasted for several days. In November of 1936 he was again in Longview, ate freely of persimmons, and was sick three days. After these at-

Fig. 1, Case 1
Bezoars visible as movable filling defects.

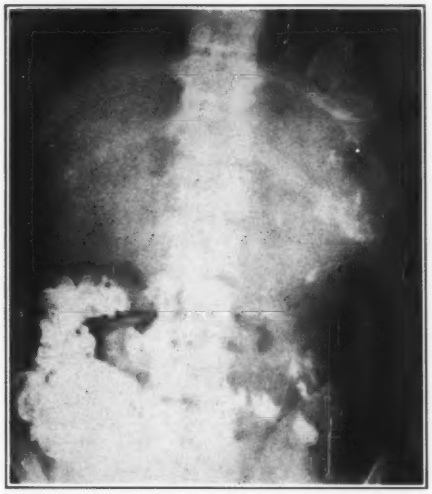


Fig. 2, Case 1
Six-hour plate showing "ghosts"—barium flecks on bezoars.

tacks, as in the present one, he could taste persimmons, but they seemed to have a fatal fascination for him and this attack did not pass off as the others had. In spite of this history, elicited after his x-rays were seen, he did not mention persimmons at my first visit to him and evidently did not associate them with his illness, though when told what he had he said he had been tasting them for two weeks.

In the past he has always been a vigorous, hard-working man with no digestive disturbances other than those above noted.

Physical examination on admission showed only a tired looking muscular man with many decayed teeth and a tense, tender abdomen. X-ray demonstrated three fairly large movable foreign bodies in his stomach. After he was relaxed with a dose of morphine two of the persimmon balls could be felt in the stomach. Gastrotomy was done through a left paramedian incision and a transverse incision in the stomach large enough to put the hand through. Three large bezoars, one high up in the fundus, were lifted out. The entire mucosa of the stomach seemed reddened and swollen. On the lesser curvature about three inches above the pylorus there was a fresh ulcer about 1.5 cm. across which did not have much induration about it and showed very little infiltration in the gastro-hepatic omentum above it. The edges were slightly undermined. It was thought that this was an acute ulcer due to trauma of the foreign bodies and it was left alone. The stomach and abdomen were closed in layers without drainage. He had a smooth convalescence, but had some stomach discomfort for about six weeks which, under alkalies and frequent feedings, rapidly improved. Since that time he has been perfectly well.

Case 2.—This case is reported through the courtesy of Drs. K. H. and F. C. Beall. Mrs. I. W., white, aged 46, was admitted to the Cook Memorial Hospital February 23, 1937. She complained of pain in the stomach.

In November, 1936, she had eaten twelve to eighteen persimmons. About four hours later she developed terrific cramps in her abdomen, was nauseated and vomited. She thought she had food poisoning, but the pain persisted. Since the initial attack she has suffered intermittent attacks of epigastric pain. The pain was of a dull, aching character with intermittent attacks of severe gnawing pain with some nausea and loss of appetite. An indefinite mass could be felt in the epigastrium and left hypochondrium and was painful to the patient.

X-ray examination showed that the stomach filled well, was slightly dilated and in the fundus there was a rather large irregular filling defect that shifted position. At incisura angularis there was a finger like projection that remained constant. The cap dilated two times, but was otherwise normal. The six-hour stomach was empty. There were no residual flecks. It was the physician's opinion that there was a foreign body in the stomach and a gastric ulcer. Gastrotomy was done through a longitudinal incision in the stomach and a large bezoar removed in several pieces. The mucosa was red and swollen and a fresh ulcer was seen on the lesser curvature. This was very lightly cauterized and the stomach and abdomen were closed.

The pathologist reported a bezoar which weighed 249 grams. Doughy, friable, brownish yellow vegetable material occurred in many sized and shaped pieces. The greater part consisted of finely granular material that surrounded varying sized yellow and light brown parti-

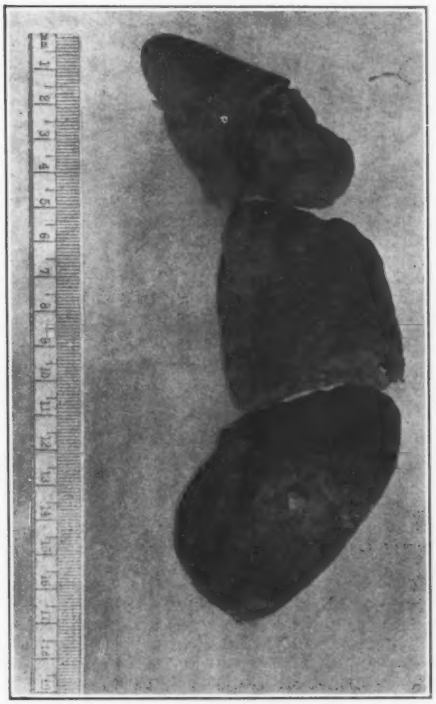


Fig. 3, Case 1
Bezoars removed from stomach.

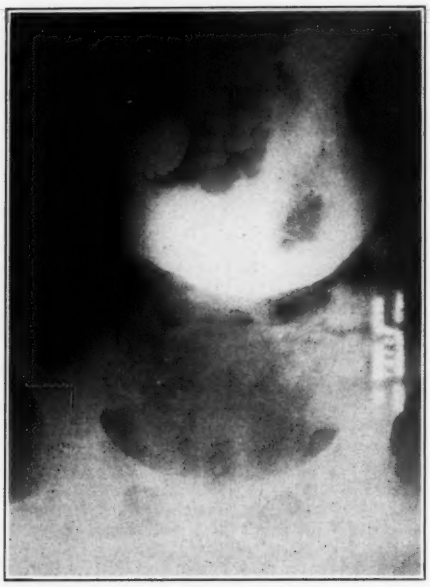


Fig. 4, Case 2
Bezoar visible as movable filling defect in the stomach.

Fig. 5, Case 3
Persimmon bezoar. Removal from terminal ileum.

cles of peeling. There were also a few persimmon seeds. Persimmon phytobezoar was diagnosed. The patient made a smooth recovery and has been perfectly well ever since.

Case 3 (No. 13474).—Mrs. G. W. H. was admitted to the Methodist Hospital at Fort Worth, June 8, 1936, with a history of intermittent cramping pain for 48 hours, followed by vomiting, which had a distinct fecal odor. Her physicians inserted a duodenal tube and applied suction, gave her intravenous fluids and several enemas. She passed some feces with the enemas, her vomiting stopped and her cramps, although never entirely relieved, became much less severe and frequent. I saw her in consultation with Dr. T. C. Terrell on June 11, at which time her cramps had recurred with great severity, although she was not vomiting. A few hours later it was obvious that she had a severe obstruction and I advised immediate operation. She had had several similar though much milder attacks during the past two years. X-ray studies of the gastro-intestinal tract had been negative and because she had had in addition to the cramps many headaches, her physicians had thought that perhaps she had a food allergy. Many years before she had been operated upon for appendicitis and had a well healed right rectus scar. I thought it most likely that her obstruction was due to a band and made an incision mesial to the right rectus scar. On picking up the terminal ileum which was collapsed to trace it back to the obstructed point about fifteen inches away from the ileocecal valve, I found a large, hard foreign body tightly wedged in the ileum. The bowel over it was not damaged or badly swollen and by manipulation it was possible to move it upward. I thought, of course, that it was a gallstone. The gallbladder was felt and was free of adhesions and, though rather tense, apparently contained no stones. Intestinal clamps were applied above and below the foreign body. The field was properly protected by gauze pads and the intestine incised longitudinally over the mass. It was removed and recognized then as a bezoar. The intestine was closed with two layers of catgut and the abdomen closed without drainage. She was very fat and had signs of some infection in the superficial layers of her wound and a low grade bronchopneumonia on her third day. These gradually cleared, but her wound infection was quite severe. She developed a rather stubborn diarrhea and low grade fever which lasted for several weeks, but finally recovered completely and has been free from intestinal symptoms ever since. She had eaten many persimmons in her life, but none since the fall before her illness.

The specimen consisted of a hard, nodular, brownish black piece of foreign material measuring 5.5 x 4 x 3 cm. Two-thirds of the surface of the specimen was dark brownish black, the other third slightly granular, brown and grey. The surface crumbled rather readily and practically the entire outside was covered with strands of grey mucus. The cut surfaces were granular, friable and mottled light to dark brown. There were many small, irregular dark brown flat particles of fruit peelings, evidently persimmons.

REFERENCES

1. Hart, W. E.: Phytobezoars. J.A.M.A., **81**:1870-75 (Dec. 1) 1923.
2. Cole, Paul F.: Jour. Mo. Med. Assn., **28**:116-120, ——.
3. Moersch, Herman J.; and Walters, Waltman: Amer. Jour. Dig. Dis. & Nutrition. **3**:15-17, ——.
4. Schmeisser, Harry C.: Sou. Med. Jour., **28**:987-92 (Nov.) 1935.
5. Thorek, Phil; and Rutter, Capitola: Trichobezoar and Phytobezoar. Amer. Jour. Surg., New Series, **35**:603-6 (March) 1937.
6. Murdock, N. D.: Jour. Okla. State Med. Assn. (Dec.) 1934.
7. Smith, Lester A.: Amer. Jour. Surg., **22**:565-67 (Dec.) 1933.

8. Schulze, Victor E.: Sou. Med. Jour., **25**:833-36 (Aug.) 1932.
9. Balfour, D. C.; and Good, R. W.: Amer. Jour. Surg., New Series, **6**:579-87 (May) 1929.
10. Maes, Urban: Trans. Amer. Surg. Assn., **46**:375-82, 1928.

DISCUSSION (*Abstract*)

Dr. Urban Maes, New Orleans, La.—My first thought, when I read Dr. White's paper, was of the enormously increased incidence of phytobezoars since I read a communication on the subject almost ten years ago. At that time a fairly thorough review of the literature revealed less than 150 cases of both hair and vegetable bezoars, and the latter group included only 23 cases. A large number of cases have been reported since that time, and although the condition is still both curious and interesting, it no longer seems to warrant the application of the adjective "rare." One thing that has always impressed me when such subjects are introduced at medical gatherings is the number of unreported cases invariably mentioned by the speakers who take part in the discussion. It proves the point made by Matas in his comprehensive report on bezoars in 1914, that even then the condition could not be called rare if unreported cases could be brought to light. At that, Dr. White's personal experience with three cases is distinctly unusual.

I was particularly interested last year in three papers published in the *Annals of Surgery* within two months of each other, two dealing with reports of intestinal obstruction due to a food bolus, in a few instances composed of persimmon bezoars, the other reporting two cases of obstruction due to persimmon bezoars. Hargrave and Hargrave, who reported the last-mentioned cases, mention the excellent prognosis, recovery ensuing in all the reported cases (some seven) of small bowel obstruction in which the outcome was noted. This is in decided contrast to the mortality reported by Griffith in 28 collected cases of food impaction, in which there were 13 deaths, or 46 per cent.

I have seen two cases of persimmon bezoar at Charity Hospital within the last two years, neither of which I handled personally. In one case the condition was recognized before operation and recovery was uneventful. The other case is rather unusual. A 10-year-old white boy was admitted with a story of acute right-sided pain of three days' duration. The onset was sudden, and the pain had been colicky since it began. It extended into the right leg, which was stiff and painful. There had been a moderate diarrhea from the onset. The patient had had three doses of castor oil, all of which he had vomited, and vomiting had been rather persistent since; the ejected material was watery and greenish. The history and findings were typical of acute appendicitis and operation was performed on that diagnosis. It revealed a normal appendix, but an obstruction at the ileocecal junction caused by a phytobezoar. This was removed and enterostomy was done. The child died twelve days after of peritonitis. Autopsy revealed another phytobezoar, also composed of persimmon seeds, and 5 cm. at its largest diameter, also in the stomach. Apparently the second bezoar had nothing to do with the fatal outcome, but it does support the suggestion made by Moersch and Walters, on the basis of their own experience, that thorough exploration is always necessary in such cases. In the case they report, although the bezoar had been diagnosed preoperatively, it was not evident at operation; a small healed gastric ulcer was found on the lesser curvature, which was not touched. Six weeks later the same symptoms recurred, again the x-ray studies revealed a phytobezoar, the diagnosis was confirmed by gastroscopy, and the elusive bezoar was successfully removed at a second operation.

Diagnosis is never difficult if one is able to obtain a history of the ingestion of persimmons or some similar article of food, particularly the ingestion to excess. The catch is that one does not always remember to ask the question, indeed has no reason to ask it in most cases. When once the suspicion is introduced, the rest is easy. Often the mass can actually be felt, and always the x-ray returns positive information. It is generally agreed that the usually good nutrition of the patient in spite of his symptoms and findings is suggestive.

I agree with Dr. White that the ulcers associated with bezoars are usually traumatic, and, like him, I should be inclined to avoid any interference with them until I was certain that they were not. Operation in the uncomplicated case should rarely introduce any other problem.

Dr. R. A. Woolsey, St. Louis, Mo.—I recently saw a 9-year-old boy with the history that ten days previously he had developed colic, and from that time on had not been able to retain any food or liquid. On abdominal palpation I found a mass in the stomach region about seven inches long and three inches in diameter. It was apparent that the stomach was filled with a foreign substance. Many questions were asked the parents about hair, and so on, but to no avail. A laparotomy was performed and the stomach was found stretched tightly like a drumhead over a perfectly hard substance. The distal end of the stomach was incised and the foreign body pushed out through this incision. The incision was sutured with two rows of catgut and abdomen closed. The lad made an uneventful recovery.

The mass was cut in two, showing a pulp that had the appearance of persimmons without any seeds. On the second day I asked the lad if he had ever eaten any persimmons and he said he had. I then asked him when he last ate persimmons and he said on the day he became sick. I asked him if he had told his mother of eating the persimmons and he said he had not, because his family had told him not to eat persimmons.

Dr. J. Q. Graves, Monroe, La.—It is interesting to note that most of the cases reported have occurred in adults, though children are greater consumers of the fruit. Another interesting feature is the variation of time between the ingestion of the fruit and the beginning of the abdominal symptoms, and also the time when the patient is forced to consult a physician. In some cases the symptoms are sufficiently grave to cause immediate consultation for relief, while in others the symptoms may be vague, intermittent and extending over a period of several months. The diagnosis of the phytobezoar in the intestinal canal producing obstruction is always made at the time of operation. Other foods produce obstruction more often than the phytobezoar. Their diagnosis is equally difficult.

Drs. Hargrave and Hargrave, of Wichita Falls, Texas, have noted the limited number of cases of phytobezoar causing obstruction of the small intestinal canal, as compared with the number found in the stomach. Five in all have been reported.

In 1921 Dr. D. I. Hirsch, of Monroe, Louisiana, operated upon a case of acute obstruction caused by two large phytobezoars located at about 15 and 20 inches, respectively, above the ileocecal valve. This patient

died with postoperative pneumonia. At autopsy it was found that a large phytobezoar was in the stomach, filling two-thirds of its normal capacity, which was overlooked at the time of the operation.

This is the only case on record in which a phytobezoar was found in the stomach and another in the small intestinal canal large enough to produce complete obstruction. The unusual feature is that in this instance the large phytobezoar in the stomach was associated with two large phytobezoars in the intestinal canal. Either of the two in the intestinal canal were large enough to produce complete blocking.

In 1932, Dr. John G. Snelling, of the Graves-Snelling Clinic, of Monroe, Louisiana, also had an obstruction of the small intestinal canal in a child 8 years of age, due to phytobezoar located near the ileocecal valve. His was a single mass. The phytobezoars were found to consist of tightly compressed persimmon pulp and hull, with quite a large number of seeds throughout. They were dark brown in color and roughened on their external surfaces. Upon opening, the color was found to be lighter and slightly reddish-pink.

These two cases have not been reported in medical literature, but will be in the near future. Added to these, the cases, one each, of Drs. Wyatt and O'Bannon, unreported, will make a total of nine cases in which the phytobezoar caused complete obstruction in the small intestinal canal.

Dr. White (closing).—Dr. Maes' paper in the *Annals of Surgery* about nine years ago reporting a persimmon bezoar and giving a masterly review of a rather scanty literature first aroused my interest in this condition. It was not until nine years later that I encountered a case and then had the unique experience of seeing three in eight months. The condition is easily diagnosed if you know what it is and offers a brilliant opportunity for relief with rather simple surgery.

PROSTATIC CALCULI*

By I. G. DUNCAN, B.S., M.D., F.A.C.S†
Memphis, Tennessee

There are three general types of stones found in the prostate:

(1) Slight calcification of small bodies in the prostate which are known as corpora amylacea. They are not true stones and are considered as normal by many.

(2) Secondary stones which are formed elsewhere, but having lodged in the prostatic urethra, and have continued to grow.

(3) The true prostatic calculi, which are found in the prostatic ducts and alveoli.

Only the last mentioned class of stones will be considered in this paper.

*Read in Section on Urology, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

†Associate Professor of Urology, University of Tennessee College of Medicine, Memphis.

Etiology.—The underlying factors are the same as those causing stones in other parts of the genito-urinary tract. Stasis, stricture of the urethra, infection and prostatic abscesses doubtless play a most important role. They are seldom found before the age of fifty, and are most often present in the very old.

Symptoms.—As there are no characteristic symptoms of stones in the prostate, many patients have them for a long time without its being suspected, and often they are found as a result of a routine examination.

However, these men not infrequently notice that the stream is gradually becoming smaller and they complain of dysuria, nocturia, hematuria and dribbling. If one of these stones should be evacuated and become lodged in the urethral canal, a complete urinary retention may result.

Upon rectal examination the prostate will be found enlarged, irregular, nodular and very hard in localized areas, and not infrequently crepitus may be noted. An exploration of the urethra will show a prostatic obstruction, and with a metal instrument a clicking sensation may be ascertained. An x-ray will show shadows in the prostate.

Fig. 1
Kidney, ureter and bladder, showing stones in prostate.

Fig. 2
(1) shows stones in prostatic sac; (2) stones embedded in the prostatic tissue; and (3) small opening in vesical neck of prostatic sac.

Carcinoma of the prostate is sometimes confused with this condition. The differential points are crepitus, characteristic click produced by a sound, and the presence of a shadow in the x-ray picture.

The most common complications are: stones in other portions of the genito-urinary tract, prostatitis, and abscess of the prostate which may rupture anteriorly to form a peri-urethral abscess, or posteriorly underneath the trigone, causing a most severe infection which may involve the peritoneum.

Pathology.—These stones usually form in the ducts and alveoli of the prostatic glands, and are always multiple, as many as 700 having been reported. As these calculi grow and become more numerous, the prostatic tissue is gradually replaced by them until there is very little of it left.

Treatment.—The large majority cause very little trouble and require no special treatment. However, those that require attention are treated as are other forms of prostatic obstructions.

If an acute retention has taken place or the bladder so distended with residual urine, drainage must be secured either by an indwelling catheter or by a suprapubic cystotomy, the latter being the method of choice, as catheter drainage rarely suffices.

When the patient is ready for operation, as much of the prostate and as many of the stones as possible are removed either by prostatectomy or resection.

The case which I shall now report, is unique in that the stones were very numerous and some quite large.

CASE REPORT

Mr. A., white, aged 80, came to our office December 22, 1936. He had been unable to void for some hours and was most uncomfortable.

He denied all venereal diseases, and had been quite well until five years previously, when he began to have frequency of urination, nocturia, and noticed that his

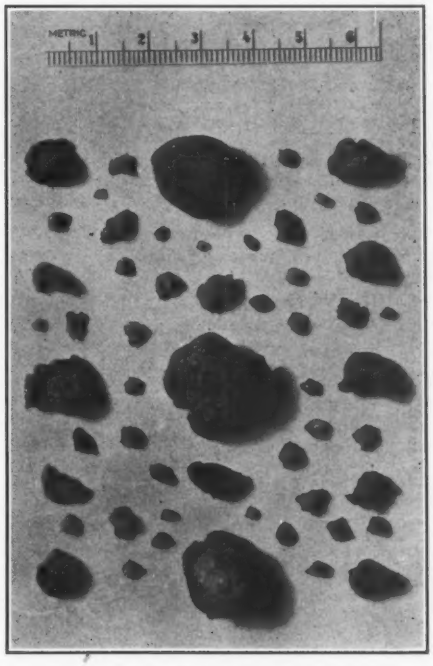


Fig. 3
Some of the stones removed at operation.

stream was not so large as formerly. His condition had gradually become worse, in spite of the treatment which he had received from his family physician.

He was a rather small man, weighing about 130 pounds. His bladder was distended up to his umbilicus and he seemed most uncomfortable. We attempted to catheterize him, but the catheter met an obstruction in his posterior urethra, past which it would not go. When a small sound was introduced, a grating feeling was experienced. After this we were able to get a catheter, not into his bladder but far enough to empty it, which gave him a great deal of relief. The catheter was strapped in with the hope that it would continue to drain.

A rectal examination showed a moderately enlarged nodular and very hard gland. Crepitus was also present, and an x-ray picture showed many shadows in the prostatic region. His urine was loaded with pus.

The next day a suprapubic cystotomy was done, as the catheter was not draining satisfactorily.

A contracture of his vesical neck was found, which protruded into the bladder very much like a cervix into the vagina. The bladder end of the posterior urethra was almost completely closed. This caused the formation of a sack, which contained so many stones that it felt like a bag filled with marbles.

As the patient was very old and the bladder infection most severe, it was necessary to drain him several weeks before any further surgery was deemed advisable.

At the next operation, the suprapubic tube having been removed, I introduced my finger into his bladder and, after rupturing the sack, removed a large number of stones. As there was very little prostatic tissue left and no line of cleavage could be found, it was impossible to do a prostatectomy. So a resectoscope was introduced, and as much as possible of the gland with its embedded stones was removed. The smaller concretions were removed through the sheath of the resectoscope, while the larger ones, when dislodged, were fished out through the suprapubic opening.

The patient's recovery was stormy, but satisfactory. He left the hospital three weeks after the second operation.

The postoperative treatment consisted of urinary antiseptics, bladder irrigations, cod liver oil tablets, and supportive measures.

His general condition was so much improved that he was able personally to supervise his farm last summer, and at the present time looks twenty years younger, although he is now 81.

In closing I wish to thank Dr. J. L. Scianni, of the University of Tennessee, for illustrating this paper for me.

1500 Commerce Title Building.

DISCUSSION (*Abstract*)

Dr. H. Fay H. Jones, Little Rock, Ark.—It is said that about 65 per cent of prostatic calculi are symptomless and are found during routine x-ray examination or at operations upon the prostate. A persistent and rebellious prostatitis should arouse suspicions of calculi. Since x-ray is the final judge in making a diagnosis of prostatic calculi, I believe we are going to find more and more prostatic calculi due to the fact that in doing a resection we usually take kidney-ureter-bladder x-rays before the operation.

During resection all of us have seen instances in which small calculi were scattered through the lateral lobes of the gland. These calculi, averaging in size from two to five millimeters, are never seen in the median or posterior lobes. A few years ago I removed four hundred stones from a patient's bladder, the stones ranging in size from 5 millimeters to 0.5 centimeter. The prostate was practically entirely calcified and some hyperplasia was present, causing complete retention.

We believe that surgical intervention by the perineal route is the treatment of choice for prostatic calculi, if surgery is necessary in the younger individuals. With the older patients, usually removal of the prostatic calculi comes as a secondary consideration, as the calculi are associated with other pathological conditions, such as hyperplasia, abscess, or organic stricture of the urethra. Recurrent cases may demand complete prostatectomy. However, in the past few years, since we have been doing transurethral resections, we have removed stones in this manner with satisfactory results and I believe in most instances this procedure will be sufficient. If the calculi are causing no symptoms, but are found in the course of a routine examination, we believe that no surgical intervention is required, but periodic observations should be insisted upon.

We have treated three cases of prostatic calculi in the past year.

In the first case, a man of 64, with chronic urinary symptoms, transurethral prostatic resection was done. The prostate was intravesically enlarged, Grade 1 in the middle lobe, and Grade 2 in the lateral globe. Moderate trabeculation of the bladder was present. Four grams of tissue were removed, and, in doing the resection, approximately one hundred prostatic calculi varying in size from very minute stones to five or six millimeters were removed.

Since operation this patient has been free of symptoms and there is no residual urine. Very probably there are still some prostatic calculi left in the prostate.

A second case, a man aged 39, developed a sharp, renal colic-like pain in the right side of the abdomen, very severe and requiring narcotics. He was discharged when his temperature subsided and has not returned. X-ray showed calcification of the prostate gland.

The third case, a man of 47, had had kidney trouble with attacks of right renal colic for years and had recently passed small stones.

An indigo carmine test revealed apparently normal kidney function. This patient had no history of bladder or prostatic trouble, but a bilateral pyelogram revealed that he had stones in each kidney as well as many calculi in the prostate.

His symptoms cleared up and he has not returned for treatment.

HEMORRHAGE AND RUPTURE OF THE ADRENAL IN THE NEW BORN INFANT*

By Sam Phillips, M.D., F.A.A.P.†
Little Rock, Arkansas

Suprarenal hemorrhage in the new born infant is a fairly common clinical entity, which unfortunately is diagnosed usually at the autopsy table. In reviewing the literature it is found that such cases are far from rare in occurrence. Dr. J. R. Losee reports in 1924 in one hundred and ninety-six stillbirths and new born babies, nine cases of suprarenal hemorrhage. Among two hundred and nineteen autopsies in 1925 he reports twelve cases of suprarenal hemorrhage. The hemorrhage had not passed the capsule, although in some cases the capsule was much distended. As to the relation between suprarenal hemorrhage and death in the new born, Dr. Losee states that he feels sure of one death from suprarenal hemorrhage. This was bilateral. The infant had convulsions, muscle spasms, and other symptoms which are otherwise considered evidence of cerebral hemorrhage, but the anterior fontanelle did not show tenseness. At autopsy a hemorrhage was not found in the brain, but there was extensive hemorrhage in both suprarenals. Hamill collected eighty-seven cases and added three more to the list. Most of these cases concern stillborn infants or infants who died shortly after birth in whom the diagnosis of suprarenal hemorrhage was not and could not be made. In the later period of early childhood, the clinical syndrome is easier to observe and diagnose. In the new born a diagnosis during life was made only once before. Corcoran and Strauss report a case which at five days of age gave all the clinical findings of an intestinal obstruction. On operation a large hematoma of the left adrenal was found, producing complete occlusion of the colon.

In order to appreciate fully just how this peculiar pathologic syndrome is brought about, a short description of these mysterious glands is here advisable. The adrenals are two small endocrine glands situated on the mesial anterior poles of the kidney, the right close to the liver, the inferior vena cava, and the duodenum, and the left close to the spleen, the stomach and the tail of the pancreas, and covered by peritoneum. In the new born infant they are relatively large organs. During the first two weeks of life, the medulla, which at birth is composed of a small collection of cells, starts to grow; the inner zone of the cortex is destroyed and is converted into a highly vascular and often hemorrhagic connective tissue layer which collapses. The medulla grows into the collapsed framework and represents the inner layer of the original cortex. Usually the cortex of the left gland is somewhat larger than that of the right. These cortices possess a capsule and hilus through which the suprarenal vein leaves. They are divided into a yellow cortex and a reddish brown vascular medulla; these parts are entirely different embryologically and functionally. The cortex produces the hormone which has been proved to be indispensable to life. The medulla belongs to the chromaffin system and produces epinephrine. Animals live perfectly well without the medullary portion, whereas, total adrenalectomy causes death. This would make the cortex seem by far the more important element. Both the cortex and the medulla are capable of regeneration. In spite of a great deal of research there still remains much to be learned concerning the exact role played by these two definite structures. Accessory suprarenals composing one or both parts are often found in the area contiguous to the suprarenals, elsewhere in the abdomen, or around the sex glands. They include the paraganglions and carotid bodies. The suprarenal gland is relatively the most vascular organ in the body. It receives six times its weight of blood per minute. Its blood supply is derived from the superior, middle and inferior suprarenal arteries, respectively, the branches of the inferior phrenic, the aorta and the renal arteries. These branches anastomose freely and form large venous capillaries that unite to form the central vein, which leaves at the hilus. The gland is very friable and vascular.

At this time I should like to present briefly a case which occurred in my practice and which came to autopsy with the hope that your discussions may lead us to a rational basis for diagnosis and treatment.

REPORT OF CASE

On July 9, 1937, an apparently normal full-term male child was born of a multipara, 30 years of age,

*Read in Section on Pediatrics, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

†Instructor in Pediatrics, University of Arkansas Medical School, Little Rock.

at the Baptist State Hospital, Little Rock, Arkansas. He weighed nine pounds and one ounce at birth. In 1929, the mother's first child was born uneventfully. In September, 1935, she had a spontaneous abortion, the cause of which was undetermined. Again in November, 1935, she had another spontaneous abortion, the cause of which also was undetermined. When pregnant for twelve weeks in the case to be reported, she developed nausea and vomiting, which seemed to continue until the twentieth week of gestation. During this period she received suprarenal cortex subcutaneously, one c. c. twice daily for three weeks. During the pregnancy there were no other apparent signs of toxemia. The urinalysis was negative and the blood pressure was around 110/65. The duration of labor was from eight to twelve hours and the delivery was a vertex, left occipito-anterior. The baby's condition on delivery was described as being normal in all respects. He cried lustily at birth. No resuscitatory methods were required.

On July 12, when he was four days of age, I was called in to see the baby. Upon examination the first impression was of an acutely ill infant. The infant seemed unusually drowsy, refused to nurse the breast or the bottle consistently. The color was a grayish pallor. He had been running fever 99.8° from the first day of birth. The respirations were very shallow and extremely rapid in rate with periods of apnea. Occasionally he seemed to rouse from his drowsy state and began to twitch convulsively, at the same time emitting a piercing shriek. The respirations at times were about a hundred and twenty per minute. The anterior fontanelle was patent and slightly depressed. There were no petechiae on the body. The chest was examined carefully and was found to be normal. Heart sounds were feeble. The abdomen was not rigid, but in the right hypochondrium a solid mass was palpable. It was about the size of a lemon, extending to the brim of the pelvis. Urinalysis showed albumin 1 plus and innumerable red blood cells microscopically. The blood count was hemoglobin 75 per cent, red cells 3,480,000, and white cells 18,640. Coagulation and bleeding time were normal. In twenty-four hours another urinalysis showed albumin two plus and a hemogram showed 45 per cent hemoglobin, 2,860,000 red cells and 30,350 white cells. Saline was given by hypodermoclysis and 25 c. c. of blood was given in the gluteal muscles. Matching for transfusion was being done, but the baby rapidly grew worse and expired on the fifth day.

AUTOPSY REPORT

The first incision in the abdomen is followed by a spurt of blood. Blood fills the entire abdomen. The right adrenal is the size of a quarter and has several ragged tears (*Fig. 1*). The blood has dissected into its substance and retroperitoneally into and around the renal capsule (*Fig. 2*). The lumbar muscles are also infiltrated with blood clots. Blood likewise seems to have dissected through the hiatuses of the diaphragm into the chest cavity. The right kidney is normal. The left kidney and adrenal are likewise normal. Microscopic sections reveal an adrenal gland largely destroyed by hemorrhage into the substance. There is thrombosis of the central vein and extensive necrosis of the cortex (*Fig. 3*).

In a consideration of any disease, the etiology, the causative factor, is necessarily of the greatest importance, for the cure of a disease soon follows the known causative factor. Goldzieher and Gordon classify the factors into three general classes.

Fig. 1
Suprarenal gland, enlarged due to infiltration with blood (personal case).

Fig. 2
Typical case of suprarenal hemorrhage showing disruption of the gland and perinephritic hematoma. (University of Arkansas Pathological Museum.)

Fig. 3

Cross section of the suprarenal gland (x 2½). The necrosis is represented by the pale areas. Elsewhere the gland is infiltrated with blood. To the right is a hematoma occupying the hilus.

(1) Those related to labor (trauma during birth, asphyxia neonatorum, trauma due to artificial resuscitation, eclampsia in the mother).

(2) Local conditions (physiological involution of adrenal cortex, stasis due to compression of vena cava between liver and vertebral column, thrombosis of suprarenal vein).

(3) General conditions (hemorrhagic diatheses, acute infections, syphilis).

The treatment in such cases, it seems, should be directed primarily to the combating of shock and exsanguination. The clinical picture clearly points to such needed measures. They certainly require immediate transfusion. Goldzieher, working on the hypothesis that there is an acute adrenal insufficiency, that many of the symptoms are produced by a lack of the cortical hormone, advocates the use of a potent cortical hormone extract. A critical study of the case here reported leads me to think that shock and symptoms of exsanguination were the striking points and that the use of interrenin would have been of little value.

In closing, I wish to acknowledge my great indebtedness to Dr. A. F. DeGroat, of the Department of Pathology, University of Arkansas Medical School, who was of invaluable help in the pathologic studies here presented.

VEGETATIVE INTIMITIS OF THE PULMONARY ARTERY IN A BOY WITH CONGENITAL INTRAVENTRICULAR SEPTAL DEFECT, PERSISTENT CONUS ARTERIOSUS AND BICUSPID PULMONARY VALVE*

REPORT OF CASE

By L. C. Posey, M.D.
Birmingham, Alabama

Infectious lesions of the right heart are infrequent. Such lesions as occur affect usually the valves, while involvement of the pulmonary artery itself is unusual. Infection may be due to several different organisms. In the case of the *Streptococcus viridans,* involvement is more apt to be on the left than on the right side. When, however, the heart suffers from congenital malformation the conditions are disturbed and infectious valvulitis on the right side is more common.

A recent case of infectious endarteritis and endocarditis of the right heart associated with congenital malformation has seemed worthy of recording.

CASE REPORT

On June 24, 1936, an 8-year-old white boy was admitted to the Pediatric Service of the Hillman Hospital with a complaint of chills, fever and cough of three days' duration. He had a history of recurrent attacks of cyanosis, unconsciousness and swelling of the feet. These attacks were brought on by exertion and had occurred at intervals since the boy was 1 year of age. On one occasion there was hemoptysis. Examination showed a well developed and slightly emaciated white boy with deep cyanosis of the skin and mucous membranes. There were dullness, tubular breath sounds, friction rub and a few rales over the right upper lung field anteriorly. The apex impulse of the heart was diffuse and forceful and the heart was enlarged to the left anterior axillary line. The first sound was loud. A systolic murmur could be heard at the apex and base. A loud "swishing" murmur was transmitted outward. The liver and spleen were enlarged. There were numerous small red petechiae over the entire body, especially marked on the abdomen and back. Some pitting edema was present over the lower extremities. Blood pressure was 104 systolic and 56 diastolic. The temperature was 103 degrees F.

On admission the laboratory examination of the urine

---

*Read in Section on Pathology, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

*From the Department of Pathology, Hillman Hospital, Birmingham, Alabama.

Fig. 1

Heart-lung mass showing patent ventricular septum, conus constriction, thickened wall of right ventricle, posterior pulmonary valve leaflet and massive thrombus extending into the branches of the pulmonary artery.

showed 12 to 15 pus cells per high power field and there was 300 mg. per cent albumin. In the blood there were 32,200 white cells per cubic millimeter with 95 per cent neutrophils. Red cell count was 3,260,000 per cubic millimeter and the hemoglobin was 55 per cent. On the day after admission *Streptococcus viridans* was recovered from the blood. The Kline test was negative. The patient had a septic fever, progressively grew worse and died seven days after entry. The clinical diagnosis was (1) congenital heart disease and pulmonary stenosis, (2) subacute bacterial endocarditis and (3) lobar pneumonia.

Postmortem Examination.—(Only significant findings are included.) Over the lower thorax and upper abdomen on the left side there was a patch of irregular dull red pinhead-sized macules. The skin of the back, including the buttocks, showed a moderate amount of dependent lividity and a striking mottling due to the presence of bright red petechiae, some of which were distinctly elevated. The liver and spleen were enlarged. The latter showed a dull red infarct at one pole. The lungs presented several dull red infarcted areas. One area located in the upper right lobe reached 4 centimeters in greatest diameter. There was a large amount of clear yellow serous fluid in the right pleural cavity.

The heart, as seen *in situ,* appeared widened and shortened so that it had become somewhat globular. The epicardium was smooth. The usual distinction between right and left chambers was not evident externally since both ventricular walls were thick and firm. There was a marked disparity in the size of the auricles, the right greatly predominating.

The pulmonary artery was unusually large and appeared thickened and firm. Over its lower anterior surface was a patch of dull red roughening. The aorta was distinctly smaller than normal. The thoracic contents were removed *en masse* (*Fig. 1*).

When the heart was opened it was found that the right ventricular wall exceeded the left in thickness; the former measured 5 to 10 mm. and the latter 5 to 7 mm. The myocardium of both sides was firm. The valve measurements were: tricuspid 7.3 cm., pulmonary 3.5 cm., mitral 5.6 cm., and aortic 3.5 cm. in circumference. The pulmonary orifice was guarded by two valves which were covered by marked ulcerative vegetations and were situated in anterior and posterior positions. The anterior valve was largely destroyed by ulceration. These vegetations continued well into the pulmonary artery to 5 cm. in the left and 2.5 cm. in the right branches. The vegetations were fungating and polypoid and in areas reached 1 cm. in thickness. They also occurred in the smaller divisions of the pulmonary tree, where the lumina were 5 mm. and less in diameter. A large plug of vegetation occluded the orifice of the superior branch of the right pulmonary artery at its origin. A dense white fold covered by endocardium jutted into the lumen of the pulmonary cone as a constricting band 1.2 cm. below the pulmonary valve. The band poorly defined a pulmonary conus arteriosus. The aortic valve was made up of three semilunar cusps and a small mass of fine vegetations involved the commissure between the anterior and left posterior cusps. An oval foramen 11 mm. in diameter connected the two ventricles through the septum. The margins of this defect were free of any ulceration or vegetation. In the right side the septal defect was between the pulmonary cone anteriorly and the medial cusp of the tricuspid valve posteriorly. The opening was directed from the right ventricle into the aortic outlet of the left ventricle, so that blood from the right ventricle impinged immediately onto the aortic cusps. The infected commissure above was in the direct path of this blood current.

Microscopic Examination.—Sections of the pulmonary artery (*Fig. 2*) showed the vegetations to be made up of fibrin which was compact toward the lumen and loose toward the intima of the artery. The free edge of fibrin was invaded by many neutrophils, some of which contained cocci occurring singly and occasionally in pairs. In some areas there were great masses of cocci.

The subendothelial connective tissue was edematous and infiltrated by neutrophils and many plasma cells. The muscle coat stained poorly a polychrome color. The muscle fibers were large and irregular. The interfibrillar connective tissue was loose and edematous. In the adventitia the blood vessels were engorged and many were surrounded by round cells and neutrophils. There was nothing unusual in sections of the myocardium. In the lungs and spleen the deep red areas were seen to be areas of shadow necrosis heavily infiltrated with red

Fig. 2

Photomicrograph of pulmonary artery, including the thrombus. Note the large bacterial abscess near free margin.

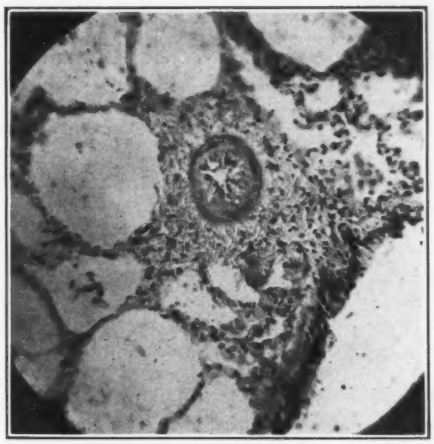


Fig. 3
Photomicrograph of small pulmonary arteriole showing a marked thickening of the intima with some vacuolation of the endothelium.

blood cells. In the surrounding lung tissue was seen acute inflammatory exudate of fibrin, neutrophils and fat-laden histiocytes filling the alveoli. Bacterial phagocytosis was frequent. The vessels of the lung showed a marked hyalin thickening of the intima with vacuolation which seemed to be located in the endothelial cells. These vacuoles did not stain by Sharlach R. These sclerotic changes were found only in the arterioles (*Fig. 3*).

DISCUSSION

In a lecture by Osler[1] in 1885, infection of the various parts of the heart in 209 cases was given as follows: aorta and mitral valves in 41, aortic valve in 53, mitral valve in 77, tricuspid valve in 19, pulmonic valve in 15, and the heart wall in 33. The right side was involved alone in 9 cases. The pulmonary valve was attacked in 4 of these, and the tricuspid in 5. Pitt[2] observed pulmonary valve lesions 16 times in 16,000 autopsies. Libman[3] recorded right heart infection in 26.8 per cent of 56 cases of acute bacterial endocarditis, while it occurred only once (tricuspid valve) in more than 100 cases of subacute bacterial endocarditis. Boldero and Bedford[4] compiled statistics on 602 cases of infective endocarditis, taken from the literature and reported involvement of the pulmonary valve in 5 per cent, while in 198 cases among the records of the Middlesex Hospital the pulmonary valve was involved in 4.5 per cent.

The infecting organism in bacterial endocarditis usually belongs to the coccus group. Thayer[5] studied 199 cases of acute and subacute bacterial endocarditis. On 138 of these cases autopsies were done. The responsible organisms were: streptococcus 57 per cent, pneumococcus 14 per cent, *Staphylococcus aureus* 13 per cent, gonococcus 11 per cent, influenza bacillus 4 per cent, and *Staphylococcus albus* 1 per cent. Libman[3] states that in subacute bacterial endocarditis *Streptococcus viridans* is causative in 95 per cent of the cases, while *Bacillus influenzae* makes up practically the remaining 5 per cent.

It is seen that the anhemolytic streptococcal infections of the right heart are infrequent and one readily asks, why? Dimmock,[6] in discussing a case of malignant endocarditis from which a hemolytic streptococcus was obtained in blood culture and in which massive infection occurred in the pulmonary artery, suggested that "the relative immunity of the right heart" is due to "lowered oxygen tension and partly to the rarity of pre-existing valvular lesions on the right side." The factors which seem related to the location of an infective endocarditis are: mechanical stress, oxygen and carbon dioxide tensions, previous injury and congenital malformation. In the left heart one finds a mechanical stress on the valves due to maintenance of a high arterial pressure. The oxygen tension in the blood is high, while the carbon dioxide is relatively low. Previous injury from rheumatic endocarditis is common. Therefore, if these factors are important, it is not unusual to expect infectious endocarditis of the left heart more often.

Mechanical stress is brought about by the high pressure, 70 to 160 mm. of mercury, maintained in the arterial side in order to effect circulation. Such continued high pressure creates a sclerosis, an area of scarring, which produces surface irregularity. The irregularities offer protection for settling bacteria from the circulating blood, and they may thereby obtain foothold and give rise to local inflammation. At autopsy it is common to find small plaques in the aorta near the aortic valves and in the aortic leaflet of the mitral valve, while the remaining vascular system is not involved in sclerotic process. Osler's[1] statistics showed a tremendous preponderance of infection in the aortic and mitral valves, both separately and combined.

When one considers the factors of oxygen and carbon dioxide tensions, it is notable that the gonococcus attacks the right heart far more commonly than does the *Streptococcus viridans*, and these organisms ordinarily grow best under conditions diametrically opposite. The gonococcus grows poorly *in vitro* under high oxygen tension, while the *Streptococcus viridans* is aerobic by choice. In the blood of a normal person Wright[7]

has given the oxygen and carbon dioxide valves as follows: arterial blood, oxygen 18.5 c. c. and carbon dioxide 52 c. c. per 100 c. c. Venous blood, oxygen 15 c. c. and carbon dioxide 55 c. c. per 100 c. c. Under influence of severe exercise the carbon dioxide of the venous blood may rise to 65 c. c., while the oxygen may fall to 3.5 c. c. per 100 c. c. These values will vary with the hemoglobin concentration, so that in marked anemia very low oxygen is found on the venous side, while the carbon dioxide may be little affected. The general tissue immunity is also lowered in anemia.

Previous injury certainly predisposes to infective endocarditis. Osler[1] and Libman and Celler[8] called attention to the great frequency of previous rheumatic infections revealed in cases of subacute bacterial endocarditis. It has usually been added that the infection is superimposed on valves least damaged by the rheumatic process. In other words, when the involvement is so severe that decompensation occurs, the factor of disturbed carbon dioxide-oxygen tension comes into play and infection does not supervene. The rheumatic heart is distorted by scarring and, like the factor of mechanical stress, offers crevices for lodgment of circulating bacteria and their subsequent growth. The factors of previous injury and mechanical stress may be combined under the heading of sclerosis or scarring, which predisposes to infection, at the same time being closely related to and dependent upon the oxygen and carbon dioxide factors.

In the case of congenital malformation infective lesions are more common on the right side of the heart. In Abbott's[9] series of 50 cases with primary defects of the basal ventricular septum, 2 had patent ductus arteriosus, 16 had dilated pulmonary arteries, 5 had hypoplasia of the aorta, 8 had infective arteritis, and 26 had hypertrophy of the right ventricle. Abbott[10] concluded that the highest incidence of bacterial infections in cardiac defects occurs in the "noncyanotic" group. In fused semilunar cusps acute endocarditis occurred in 45 per cent of 46 cases, while in defects in the upper part of the interventricular septum it occurred in 40 per cent of 40 cases. She calls attention to the low incidence of infections in cases of lower interventricular and upper interauricular septal defects which contrasts greatly with the high incidence among cases of lower interauricular and upper interventricular septal defects. In other words, she draws the inference that the proximity of the defect to the valvular endocardium increases the vulnerability of the margin of the defect, partly because this is the seat of strain and possibly also because, as suggested by Louis Gross (1924), the retrogression of the vascular supply to the valves, which normally occurs at the end of fetal life or early in infancy, has also been inhibited in the arrest of development of the parts.

Lewis and Grant[11] demonstrated that subacute infectious processes were associated with a weakened arterial coat at an area of sclerosis or progressed from a crevice in a valvular deformity which acted as a trap or nidus for the lodgment or accumulation of bacteria circulating in the blood stream. This favors the development of a vegetative process which spreads by contiguity, often with rapidity in marked contrast to the relatively innocuous character of the causative organisms.

In considering the cause of pulmonary endarteritis the factors of mechanical stress (scarring and fibrosis) and oxygen and carbon dioxide tensions again come to light. Abbott[12] states that dilatation of the pulmonary artery is common in the presence of arteriovenous shunts. The dilated artery may be athermatous even in young subjects. She refers to the case of Abrahams (1913) as a demonstration of this. Martinez and Llambias[13] observed in a young woman with basal interventricular septal defect a very marked arteriosclerosis of the pulmonary arterial tree. Durno and Brown[14] cited a case of death from dissecting aneurysm of the pulmonary artery which had its origin in an atheromatous pulmonary artery of a young man with a patent ductus arteriosus. Abbott[12b]

Fig. 4
Diagram of circulation (fashion of Abbott and Dawson).

states that luxuriant pulmonary artery vegetations have been described in various reports of instances where the pulmonary and systemic circulations communicate. Thus Boldero and Bedford[4] have summarized 36 cases of pulmonary infectious endarteritis taken from the literature, and found patent ductus arteriosus in 13, ventricular septal defects in 12, pulmonary stenosis in 7, patent foramen ovale in 6, defects of the pulmonary valves in 2 and stenosis of the conus arteriosus in 2. In the presence of upper interventricular septal defects or patent ductus arteriosus a delicate ventricle and pulmonary artery are required to carry a pressure of from 75 to 90 mm. of mercury above the normal. It can be seen that this increased load in the right heart will lead to the scleroses described above. A glance at Boldero and Bedford's statistics shows that in such defects infective pulmonary endarteritis is far more common. In addition to the stress there is a greater abundance of oxygen in the pulmonary artery in the presence of these malformations. Further support of these contentions is given in the cases recorded by Schlaepfer,[15] Krzyskowski[16] and Philpott,[17] in which pulmonary endarteritis involved the fibrosed areas of the artery opposite and about the orifice of a patent ductus arteriosus. It is in these areas that fibrosis first forms. Gordon and Perla[18] reported a case of pulmonary endarteritis in which a patent ductus and congenital pulmonary stenosis were present. In all four of these cases the endocardium was free of any vegetations. Hamilton and Abbott[19] studied a massive pulmonary endarteritis due to a pneumococcus, in which the endocardium was not involved and a patent ductus arteriosus persisted. Peters[20] cited a case of cor triloculare biatrium in which a pulmonary endocarditis lenta developed. The vegetations were present in the ventricles and mycotic aneurysms were present in the pulmonary arterial branches. Eakin and Abbott[21] described a case with marked constriction of the conus arteriosus in which a vegetative endocarditis involved the constriction and the pulmonary valves. The foramen ovale was patent while the interventricular septum was closed. Tulley and Moore[22] recorded a case with pulmonary stenosis and patent foramen ovale where a marked vegetative endocarditis involved the pulmonary valve cusps and an endarteritis occurred on the anterior wall of the pulmonary artery. The infection was due to a pneumococcus.

The present case is that of a basal interventricular septal defect with congenital constriction of the conus arteriosus and bicuspid pulmonary valves. A massive infectious endocarditis of the pulmonary valves and endarteritis of the pulmonary artery was produced by a *Streptococcus viridans*. The lungs contained numerous mycotic emboli. The right ventricle was greatly hypertrophied and the pulmonary artery was slightly dilated. A diagram of the circulation demonstrates the blood current and explains the small focus in the aortic valves as well as the infarct of the spleen. Both depend upon the presence of the interventricular septal defect. It is believed that the site of infection in this case can be explained on the basis of sclerosis due to increased pulmonary arterial tension, which is verified by the hypertrophy of the right ventricle and the sclerosis of the pulmonary arterioles (*Fig. 3*). Also, the pulmonary artery carries blood richer in oxygen than normal, thereby favoring *Streptococcus viridans* growth.

In closing, reference should be made to the apt statement of Sir James Paget made in 1844 (cited by Abbott.[10]). Paget was the first to record pulmonary endarteritis which originated on congenitally bicuspid pulmonary valves in a girl who had gonorrhea. He stated that "parts which, from defective or erroneous development are wrongly shaped, are often at the same time imperfect in their tissue, and therefore very liable to disease."*

BIBLIOGRAPHY

1. Osler, Wm.: The Gulstonian Lectures on Malignant Endocarditis. Brit. Med. Jour., **1**:467, 522 and 577, 1885.
2. Autt: Cited by Dimmock.[6]
3. Libman, E.: Characterization of Various Forms of Endocarditis. J.A.M.A., **53**:813, 1923.
4. Boldero, H. E. A.; and Bedford, D. E.: Infective Endocarditis in Congenital Heart Disease, Involving the Pulmonary Artery. Lancet, **2**:747, 1924.
5. Thayer, W. S., 1925, cited by P. D. White: Heart Disease. New York: The Macmillan Company, 1932.
6. Dimmock, A.: Malignant Endocarditis: Case Report. Jour. Med. Assn. Ga., **21**:174, 1933.
7. Wright, S.: Applied Physiology. Humphrey Milford. New York: Oxford University Press, 1931.
8. Libman, E.; and Celler, H. L.: The Etiology of Subacute Infective Endocarditis. Amer. Jour. Med. Sci., **140**:516, 1910.
9. Abbott, Maude E.: Atlas of Congenital Heart Disease. New York: American Heart Association, 1936.
10. Abbott, Maude E.: On the Incidence of Bacterial Inflammatory Processes in Cardiovascular Defects and on Malformed Semilunar Cusps. Ann. Clin. Med., **4**:189, 1925.
11. Lewis, T.; and Grant, R.: Observations Relating to Subacute Infective Endocarditis. Heart, London, **10**:21, 1923.
12. Abbott, Maude E.: Osler's Modern Medicine, **4**: (a) 742, (b) 650.
13. Martinez, G. N.; and Llambias, J.: Concerning a Case of Congenital Malformation of the Heart Accompanied by Arteriosclerosis of the Pulmonary Artery. Prens. Med. Argent., **16**:101, 1929.

*The author is greatly indebted to the Executive Committee of the Hillman Hospital for permission to publish this case, to Dr. George S. Graham, Pathologist, Hillman Hospital, for many helpful criticisms, suggestions and aid in photography, and to Dr. Maude E. Abbott, who kindly supplied reprints of her early studies.

14. Durno, L.; and Brown, W. L.: A Case of Dissecting Aneurysm of the Pulmonary Artery: Patent Ductus Arteriosus. Rupture of the Pericardium. Lancet, **1**:1693, 1908.
15. Schlaepfer, K.: Chronic and Acute Arteritis of the Pulmonary Artery and of the Patent Ductus Arteriosus. Arch. Int. Med., **37**:473, 1926.
16. Krzyskowski, 1902, cited by Schlaepfer.[15]
17. Philpott, N. W.: Vegetative Endarteritis of the Pulmonary Artery Complicating Persistent Ductus. Ann. Int. Med., **2**:984, 1929.
18. Gordon H.; and Perla, D.: Subacute Bacterial Endarteritis of the Pulmonary Artery Associated with Patent Ductus and Pulmonic Stenosis. Amer. Jour. Dis. Child., **41**:98, 1931.
19. Hamilton, W. F.; and Abbott, Maude E.: Patent Ductus Arteriosus with Acute Infective Pulmonary Endarteritis. Trans. Assn. Amer. Physc., **29**:284, 1914.
20. Peters, M.: Cor Triloculare Biatrium with Pulmonary Endocarditis Lenta: Formation of Embolic Mycotic Aneurysms of Pulmonary Artery. Centralbl. f. Allg. Path. u. path. Anat., **57**:52, 1935.
21. Eakin, W. W.; and Abbott, Maude E.: Stenosis of the Pulmonary Conus at the Lower Bulbar Orifice (Conus a Separate Chamber), and Closed Interventricular Septum with Two Illustrative Cases. Amer. Jour. Med. Sci., **186**:660, 1933.
22. Tulley, H. E.; and Moore, J. W.: Report of a Case of Congenital Pulmonary Stenosis with Acute Inflammation of Pulmonary Valve and Artery. Amer. Jour. Dis. Child., **13**:426, 1917.

DISCUSSION (*Abstract*)

Dr. Harvey S. Thatcher, Little Rock, Ark.—The subject of congenital hearts is an almost unexplored field in the South, and certainly valuable material is here.

Carl Rokitansky had an unexcelled amount of material at the Allgemeines Krankenhaus. He was especially interested in congenital malformations of the heart and performed autopsies in minutest detail. His most outstanding work was "Defects in the Septum of the Heart, 1875." In the congenital anomalies are the principal features with embryological production of the defects just as predicted.

Dr. Maude E. Abbott of Montreal, last year (1936) published her remarkable "Atlas of Congenital Cardiac Disease." She was inspired by Osler many years ago to do this work. She related her studies to clinical medicine. This is her most important contribution, because pathology is medicine.

In her atlas, our case of "Both Pulmonary Veins Emptying Into the Coronary Sinus" is published. One other similar case has been reported by Nabarro in 1902. Our report was unusual because the child lived 2 years, 4 months and 8 days, while the child reported by Nabarro lived only 5½ months.

We also have another specimen of cor biloculare with pulmonary and coronary arteries coming off the aorta from a single branch. From the arch of the aorta below the left innominate artery there is an arch which comes downward to the right and opens into the pulmonary artery (sixth branchia arch). There is no division of the right and left ventricles, but a small ridge posteriorly might be considered the remnant of the septum. The child was seven days old.

Dr. E. H. Lawson, New Orleans, La.—The essayist is to be congratulated upon taking advantage of this opportunity to observe a rare and interesting case; and upon the thoroughness of his investigation. The rarity of such a condition is definitely brought to mind if one reviews the literature on the subject for the past few years. During this interval there have been reported six cases of infection of the pulmonary artery in congenital heart disease, four in the United States and two in foreign countries. The case reported by Sprenkel and Stewart in the *Journal of Laboratory and Clinical Medicine*, 1935, resembles closely Dr. Posey's case. These authors ascribe the same causes to the involvement of the pulmonary artery as does Dr. Posey.

During the past ten years at the Southern Baptist Hospital, New Orleans, five cases of congenital heart disease have been observed at autopsy. Four of these were reported in the *New Orleans Medical and Surgical Journal*, 1935. None of these, however, presents any concurrent infection, and all succumbed to the effects of the malfunction of the heart.

Inasmuch as the case presented by Dr. Posey shows a blood stream infection, I should like to ask him if he determined the source of this infection.

Dr. Posey (*closing*)—I am sorry the lesion of this case was not more clearly emphasized. In brief, the heart presented an interventricular septal defect, bicuspid pulmonary valve and persistent pulmonary conus. Superimposed was a massive pulmonary endocarditis and endarteritis (intimitis). I am not able to state the source of the original infection, but it is believed that the presence of scarring and sclerosis in the pulmonary artery along with increased oxygen in its blood were factors predisposing the artery to infection with the *Streptococcus viridans*.

TRAUMATIC CHYLOTHORAX*

By R. T. SHACKELFORD, M.D.
and
A. M. FISHER, M.D.
Baltimore, Maryland

The occurrence of chylothorax complicating injuries of various types is rare. Inasmuch as we have recently had, under our care, two such cases, we felt it might be of value to report our experiences and summarize the literature on the subject.

The presence of true chyle in the thorax is an indication that there has been an injury or obstruction to the thoracic duct or its radicles and the many causes for this condition have been classified by McNab[5] as shown by *Table 1*. This paper, however, will be limited to a discussion of only the first of these groups, namely, the instances of traumatic chylothorax.

Reports of these cases have been uncommon; Longelot, in 1663, was the first to mention the condition, but not until Quincke's[17] communication in 1875 was such an occurrence described in detail. Zesas,[12] in 1912, collected 18 such cases, to which McNab[5] added 15 in 1932. A careful survey of the literature revealed the pres-

*Read in Section on Surgery, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30–December 1-2-3, 1937.

*We wish to thank Dr. W. W. Palmer, of the Presbyterian Hospital, New York City, for permission to report Case 1, and for his help in securing the follow-up data for us.

Table 1

CAUSE OF CHYLOTHORAX

I—Traumatic
1. Closed trauma
(a) Without fracture of bones
(b) Accompanied by fractured ribs, clavicle or vertebrae
2. Operative wounds
(a) Duct severed
(b) One or more terminals severed
3. Gunshot or stab wounds

II—New growths and granulomata outside of duct
Carcinoma, lymphosarcoma, tuberculosis glands

III—Thrombosis of left subclavian vein

IV—New growth within duct

V—Perforating lymphangitis

VI—Aneurysm of duct

VII—Cirrhosis of liver

VIII—Filaria

ence of 13 others, of which, however, only 6 were described at sufficient length to be included in this tabulation. We should like, also, to give an account of the two patients who recently came under our personal care, and then to summarize the total of 41 cases on record at the time of this writing.

Case 1 (No. 254998).—Mrs. K., a 45-year-old German housewife, came to the Presbyterian Hospital of New York, where she was first seen on May 3, 1930, by one of us (A.M.F.). On arrival she complained of swelling of the abdomen for three weeks. Her family and past histories were uneventful. Her present illness dated back to one month before her admission to the hospital. At that time she was walking along a ledge below Riverside Drive, New York City, when she slipped, fell 18 feet and landed with her back across a railroad track. She was taken to another hospital in an ambulance, examined in the accident room, and sent home following a diagnosis of minor contusions of the lumbar region. For two weeks following her accident she remained in bed at home, complaining of severe pain over her lumbodorsal spine and in both lumbar regions, particularly upon flexing her lower limbs. One week after her injury she noticed swelling of her abdomen, which gradually and progressively enlarged, and for several days before admission she had developed a distinct and increasing dyspnea.

The physical examination showed a patient who was obviously sick, anemic and dyspneic. Percussion and auscultation indicated the presence of a large amount of fluid in the right chest. The abdomen was distended and likewise showed the signs of containing free fluid. The spine was inflexible in its lumbar portion and subjectively painful on movement, but no tenderness to pressure was demonstrable in this region. The urine was normal, with the specific gravity of subsequent specimens ranging from 1.011 to 1.020. It contained a small amount of fat on several occasions. An x-ray of the spine revealed a fracture of the anterior lip of the body of the eleventh dorsal vertebra without displacement.

The right chest and abdomen were tapped and a quantity of milky fluid obtained from each. The patient was placed on a hyperextension frame. The fluid reaccumulated in both cavities, necessitating one additional thoracentesis and three paracenteses. These can best be tabulated as shown in table at bottom of this page.

No attempt at dietary or other special therapy was made. She was fitted with a spinal brace and discharged from the hospital July 12, 1930. She returned to the out-patient department for repeated examination and x-ray, her last visit being on March 9, 1936, at which time a roentgenogram showed union of her previously fractured eleventh dorsal vertebra. In the interim she had had no reaccumulation of fluid nor recurrence of symptoms. She had returned to her normal activities and is apparently completely recovered.

Case 2 (U. M. H. No. 39933).—On August 4, 1935, about midnight, Miss M. O., a 20-year-old student, was sitting in the driver's seat of her automobile, which was parked as she bade goodbye to several of her friends. Without warning, a truck crashed into the rear of her machine, throwing her violently on the rebound against the steering wheel and dashboard, shattering the former. She was brought to the Union Memorial Hospital, where she was found to have extensive lacerations of her right leg and scalp, a posterior dislocation of her right hip (verified by x-ray) and a fracture of the sixth rib posteriorly, on the left, without displacement. She did not seem dangerously hurt and made use of a telephone to communicate with her family. Because of the more urgent needs of her companions, it was four hours before she was anesthetized (examination of her heart and lungs at that time was negative), her wounds were repaired and the hip was reduced. She recovered normally from her anesthetic, passed the afternoon receiving members of her family and seemed in good general condition. At 8:00 p. m., twenty hours after the accident, she suddenly became extremely dyspneic, cyanotic and developed the signs of fluid in her right chest. The urine was examined for fat and none was found. She was placed in an oxygen tent. Later in the evening her condition became critical, but was strikingly relieved by a paracentesis of a hemopneumopericardium which had developed during that period. The following morning a diagnostic thoracentesis revealed a right hemothorax. On August 5, at 9:00 p. m., because of the patient's critical condition, a right thoracentesis followed by a transfusion of citrated blood, was performed. At this time the

	Paracentesis			Thoracentesis		
	Amount	Sp. Gr.	Fat Per Cent	Amount	Sp. Gr.	Fat Per Cent
May 4	5000 c. c.	———	———	1200 c. c.	———	———
May 8		———	———	2500 c. c.	1.016	1.67
May 11	3500 c. c.	1.015	1.36			
May 19	5300 c. c.	1.018	1.67			
June 4	4500 c. c.	1.018	———			

fluid in the right chest was found to be chyle, mixed with blood. Her condition remained critical and repeated daily and twice daily thoracenteses were necessary to remove the rapid reaccumulations of chyle. A trocar thoracotomy with tidal irrigation was unsuccessful because the tube clogged with clumps of coagulum. On August 17, a rib resection was performed. Her convalescence was slow and the exact date of the cessation of chylous drainage could not be determined with accuracy. During the acute stage of her illness, wasting and oliguria were marked, while the hemoglobin rose to 105 per cent and the specific gravity of the urine was elevated to 1.036. She returned to her home, in another city, on September 24, at which time a draining sinus from her right chest persisted, the other injuries having completely healed.

Three months later she returned for obliteration of her chronic empyema cavity, which was accomplished by means of resection of the four ribs comprising its roof. After an interval of two months she reappeared with a critical acidosis, necessitating energetic but successful intravenous therapy, and once again following a period of two months she returned with a severe avitamin polyneuritis affecting her posterior tibial and optic nerves. This was relieved by alcohol injection of the posterior tibials and vitamins parenterally and by stomach tube. Her recovery was apparently completed about 16 months after the date of injury and she has remained well at the present writing.

A word should be said about the diagnosis of the chylous effusion. At first, when mixed with blood, it gave the gross appearance of creamy pus, but when examined microscopically the large fat globules, readily stained with sudan III, were obvious. After remaining in a test tube over night it had separated into two layers, the upper creamy in appearance, while the lower was colorless and opaque.

In view of the paucity of records, only 41 cases being available, it is apparent that this condition is very rare, has been overlooked, or has not been reported. The second possibility should not be dismissed lightly, inasmuch as in four instances the chylothorax was mistaken for an empyema.

The condition occurred predominantly in males, in a ratio of 35:6, which is true of trauma in general.

Age was not a factor, the two extremes being 9 and 62 years.

The types of injury are analyzed in *Table 2*

Table 2

CAUSES OF TRAUMATIC CHYLOTHORAX

Crushing injuries	17
Wounds (bullet or stab)	8
Fall from a height	6
Blow on the chest	5
Thrown against front seat of an auto	4
Hyperextension	1
Total	41

and this illustrates the preponderance of crushing forces as a causative factor. However, there were a considerable number of instances in which the force was not violent (cases 14, 42 and 46), nor associated with any recognizable injury in other structures. These resulted from such minor accidents as being struck in the chest by a swing, striking one's side against a window sill, and falls of only a few feet. This particular group suggests the probability of rupture of the thoracic duct due to sudden changes of intrathoracic pneumohydrostatic pressure. The majority of those following crushing injuries were associated with fractures of the bony skeleton in the region of the thoracic cage, namely, ribs, clavicle, vertebrae. In some instances the lesion could be explained as having resulted from direct injury to the duct by the displaced bony fragments, or from its compression by the accompanying hematoma; but on the other hand, in a considerable number, the fracture was at a distance from the ruptured vessel and again pneumohydrostatic force seemed the most likely mechanical factor.

A few of the reports mention that accidents occurred shortly after a heavy meal, at which time, we have reason to believe, the intraductal pressure is greatest and the explosive power of sudden changes in pneumohydrostatic force would be the most destructive.

The clinical picture was striking in certain particulars. Following the injury, which in 19 cases was thought to be minor, there appeared a latent period of more than 24 hours before the presence of fluid became evident. This interval varied from two days to six weeks, most commonly was of four days duration and was present in 33 of the 41 patients. In 12 instances the appearance of the effusion was marked by a sudden onset of extreme dyspnea and collapse. This phenomenon occurred in some with a long and others with a short period of latency. In only 5 other cases was the mode of onset described and in these the development of dyspnea was gradual. Paitre[7] believed this sudden change to be due to anaphylactic shock, while Lecone[5] expressed the view that protein intoxication from the reabsorption of chyle was the cause, and McNab[5] said that in his opinion a sudden pneumothorax was the etiological factor. Based on the description of an autopsy,[5] our explanation of this acute onset is that at the site of the rupture of the vessel the escaped fluid becomes encysted; the encystment enlarges, causing necrosis of the adjacent pleura and finally bursts,

precipitously flooding the pleural cavity. None of these theories has been conclusively proven.

A second clinical characteristic was the rapid reaccumulation of chyle, averaging two litres per day and, in one report, totalling a measured loss of 72 litres during the patient's illness.

A third variable sign was a marked diminution of urinary output in spite of an increased thirst; and last, in nearly all the cases there was a rapid loss of weight, those dying showing extreme emaciation.

The diagnosis on each occasion was made by thoracentesis and microscopic examination of the fluid. The chyle, after standing, separated into a supernatant creamy layer in all the reports in which this point was mentioned. In one case, proven by autopsy to have a ruptured duct,[6] the specific gravity of the fluid was 1.006, well below the 1.012 which Wallis and Schölberg[19] have chosen as the dividing line between pseudochylous and true chylous effusions. As stated above, in four cases without microscopic study, the gross appearance of the fluid led to the erroneous diagnosis of an empyema.

The twelve injuries due to open wounds resulted in 9 left, 1 bilateral, and 2 right sided chylothoraces. The explanation of this preponderance on the left is relatively simple, as in all but one the wound was on that side.

The closed injuries, however, revealed as great a difference in the reverse direction as shown by *Table 3*. Nineteen developed a right, 5 a left,

Table 3

Location of Effusion	Open Injuries	Closed Injuries	Total
Left chylothorax	9	5	14
Right chylothorax	2	18	20
Right chylothorax with chylous ascites	0	1	1
Bilateral chylothorax	1	4	5
Bilateral chylothorax with chylous ascites	0	1	1
Left chylothroxa with chylous ascites	0	0	0
Total	12	29	41

and 5 bilateral chylothoraces. The explanation of this reversal is not entirely clear to us. Anatomically, we know that in the lower thorax the thoracic duct is to the right of the midline, but only slightly so, and that it gradually crosses to the left during its ascent to enter the blood stream at the junction of the left subclavian and internal jugular veins. Four autopsies of cases of right chylothorax were reported wherein the site of the ruptured duct was found and in all four this point was at or below the level of the tenth thoracic vertebra. In the three autopsied individuals with a left chylothorax the rent on each occasion was found in the upper thorax, while in the one bilateral case the opening was found at the level of the third thoracic vertebra.

In the patient with bilateral effusion plus chylous ascites, the lesion was demonstrated 2 cms. above the diaphragm. These figures suggest, but by no means prove, that a right chylous effusion indicates a low injury to the duct and vice versa, and the only explanation we have to offer is this small anatomical difference in position of the duct as described above.

Traumatic chylothorax has been associated with a high mortality; 19 died and 21 recovered (in one case the result is not known). Fifteen of the former were autopsied and in 10 of these the actual rupture of the duct was demonstrated. In 5, this was due to penetration by a fractured adjacent bone, and two were severed by a bullet or knife. In the other three, the duct was apparently exploded by compression alone. The five in which the rent was not actually seen did not have the duct artificially injected postmortem, which is the surest method of locating the opening.

The treatment of chylothorax has been varied and unsatisfactory as shown by the high mortality. The results are best seen by reference to *Table 4*.

Table 4

Method of Treatment	Recovered	Died
Thoracentesis only	12	8
Thoracentesis and low fat diet	1	0
Rib resection	5	4
Rib resection and low fat diet	1	0
Thoracentesis and chyle intravenously	1	1
Thoracentesis and rectal feeding	1	0
Low fat diet alone	0	1
No treatment (result of one not known)	0	3
Not described		2
Total	21	19

An analysis of these figures indicates slightly better results with repeated thoracenteses only and most authors have suggested that these be performed as infrequently as is necessary to relieve the dyspnea. They have maintained that obliteration of the negative intrapleural pressure prevents the suction of chyle into the cavity. Others have claimed that open thoracotomy accomplished the same result due to the admission of atmospheric pressure. We believe that the choice depends upon the rapidity with which the fluid accumulates and whether it becomes

Table 5

Author	Date	Age and Sex	Nature of Trauma	Clinical Course	Side	Therapy	Result	Autopsy Findings
1 Dienbock[5 13]	1695	?	Kicked in abdomen by a mare	?	?	?	D	Autopsy showed ruptured thoracic duct site ?
2 Hoffman[13]	1700	F	Stab wound of left chest	Patient wasted away and aborted pregnancy	L and R	?	D	?
3 Bonet[13]	?	M	Bullet wound of spine, exit at left scapula	Wound seemed minor; 14 days later chylous effusion. Healed, but returned after eating	L	Effusion lasted 28 days. Restricted diet	D	None
4 Quincke[13 17]	1875	M 50	Crushed by a wagon	Seemed minor injury. Developed effusion the third day	R	Repeated thoracenteses every 2 days. Died on twenty-first day	D	Seven litres of chyle in rt. pleura. 7-9 ribs fract. anteriorly. No hole found in duct or pleura. No injection.
5 Kirchner[13 21]	1885	F 9	Struck side against wooden sill	Minor injury. Tenth day effusion; occurred just after eating	R	One thoracentesis; fluid recurred, but fully absorbed in 2½ months. Suggested contrecoups	R	
6 Krabbell[13]	1885	M 16	Crushed by wagon	Effusion developed following day. Died of asphyxia	R ?	None. Died on fifth day	D	Six litres of chyle. Fract. ninth thoracic vertebra and thoracic duct ruptured by bone
7 V. Thaden[13]	1887	M 31	Fall from a mast	Fifth day effusion developed. Died on the twentieth day	R	6-11-17 days had thoracenteses, 7,000 c. c. total of chyle	D	Fract. 8-9 ribs on left. One litre of chyle in rt. chest. Hole not found in chest or pleura. Not injected
8 Helferich Port[13 37]	1894	M 35	Crushed and hyperextended over a cylinder	Minor injury. Fourth day effusion, wt. loss. Returned in 3 weeks with nephritis	R	Two thoracenteses and then rib resection on sixth day. Well in 4 weeks	R	Nephritis developed 3 weeks later, from which he died. No autopsy
9 Hensen[29 25 13]	1897	M 19	Crushed by wagon	Minor injury. Three days later bilateral effusion	R and L	Bilateral thoracenteses Well in 14 days	R	
10 Weisinger[4]	1898	M 16	Crushed by revolving motor spoke	Next day bilateral effusion. Fract. right clavicle and first five ribs; also left clavicle	L	Diagnostic thoracenteses. Effusions absorbed in 3 wks. Had chylothorax on left and hemothorax on right	R	
11 Handmann-Kummell[65]	1899	M 22	Struck in chest by swing	Minor injury. Two days later an effusion	L	Three thoracenteses	R	
12 Hahn[13]	1899	M	Run over by a carriage	Sudden shock and dyspnea on eleventh day. Wasted away	R	Repeated thoracenteses every 2 days until he died on twenty-sixth day. Twenty-nine litres withdrawn	D	Ninth and tenth ribs fract. on rt. Seven litres in rt. cavity. Duct ruptured by callus of tenth rib on right
13 Legg[10]	1899	M 62	Run over by a cab	Badly hurt. Bil. effusion next day	R and L	None. Died on sixth day	D	Second rib fract. on left near sternum; second rt. rib near spine; third and fourth dorsal vertebrae fract. Rupture of duct not seen. No injection
14 Dietze[43 13]	1903	M 39	Shot himself in left chest	Wounded in sixth left i. s. Three days later effusion. Wt. loss	R	Eight thoracenteses, withdrawing 77 litres Wt. 160-128 lbs. Well in 42 days	R	
15 Newman[15]	1903	M 36	Crushed by a stone	Fract. both clavicles in middle; 4th, 5th, 6th, 7th ribs front and back. Effusion on third day	L	Repeated thoracenteses of 18,600 of chyle. Subcutaneous emphysema	R	
16 Lindstrom[48 13]	1905	M 18	Fell on left side and broke rib	Minor injury with fract. left rib. Fourth day effusion	R	Thoracenteses and then rib resection	D	Rupture of duct at site of fract. left rib near spine
17 Hammesfahr[20]	1907	M 10	Kicked by a horse in left sterno-clavicular region	Minor injury. Fifth day bil. chylothorax. Well in 8 days	L and R	Two thoracenteses, one from each chest. Three liters from left, 3½ litres from right	R	

Author	Date	Age and Sex	Nature of Trauma	Clinical Course	Side	Therapy	Result	Autopsy Findings
18 Oeken[36]	1908	M 20	Crushed by stone	Minor injury. Fifth day rt. effusion. Scanty urine, inanition. Lived 14 days		Injected chyle intramuscularly. Repeated thoracenteses. Twenty litres	D	Six litres chyle in rt. Small opening found beside, but not into thoracic duct. No bone injury
19 Slajmer[44]	1912	M 27	Run over by a carriage	Minor injury. Effusion on fourth day. Well in 15 days	L	Two thoracenteses totaling 3,100 c. c. chyle	R	
20 Bohne-Lowenstein[45]	?	M 33	Fall from a mast	Fract. ribs on right and also spine. Died in 2 days	R	None	D	500 c. c. blood in left. 1,500 c. c. chyle in rt. Tenth vertebra fract. and at that level duct ruptured. Rt. 10-12 ribs fract. at spine
21 Bohne-Lowenstein[45 12]		F 21	Shot in the neck	Immediate dyspnea and fluid. Died on fifth day	L	Thoracenteses on first and fifth days. 2,100 and 1,900 c. c.	D	Left chest had 1,300 c. c. chyle. At apex left lung is perforation of pleura and duct severed at junction to vein
22 Derganz[33]	1915	M 20	Gunshot in right sterno-clavicular and exit left spine and scapula	Next day developed fluid and air in left chest. Eleventh day sudden dyspnea; thirst marked; well in 2 mos.	L	Thoracenteses. Rib resection on thirtieth day. Fluid mistaken for empyema	R	
23 Eliott and Henry[11]	1917	M	Shrapnel wound in right clavicle and ant. left axilla	Pt. walked 1 mile after injury. Fourth day emphysema and effusion left chest. Well in 10 days	L	Thoracenteses followed by rib resection on the eighth day. Mistaken for empyema	R	
24 Elliott and Henry[11]	1917	M	Bullet wound throat below thyroid	Minor injury. Fourth day chylothorax. Died on eleventh day from perfringens infection	L	Thoracenteses followed by rib resection on the fifth day	D	Bullet wound of trachea below cricoid. Exit on left then through apex of pleura. Actual hole in duct not found; clotted chyle in chest
25 Malone and Wardrup[10]	1919	M 22	Fall from a mast	Minor injury and was not treated. Ten days later dyspnea and emaciation. Died in 24 days	R	Twelve thoracenteses totaling 48,840 c. c.	D	No injury to thoracic duct found at autopsy. Duct not injected. No other injuries
26 Lindenfeld[4]	1919		Struck on right chest	Chylothorax 3 weeks later	R	Thoracenteses	R	
27 Watts[9]	1921	M 35	Stab wound suprasternal notch	Chylothorax next day with inanition, thirst and anemia. Died in 3 weeks	R and L	Thoracenteses. Advised against rib resection	D	Left pleura and thoracic duct severed. Chyle in both chests
28 Lindenberg[30]	1926	M 33	Crushed between 2 wagons	Walked into hospital fourth day with sudden dyspnea; scanty urine. Well in 5 wks	R and L	Repeated thoracenteses totaling 10.6 litres. Left stopped first	R	
29 Lenormant and Grimault[8]	1928	M 36	Struck by auto after full meal	Operated on for fract. skull. Six weeks later chylothorax. Well in 5 months	R	Three thoracenteses totaling 12 litres	R	
30 Spaciabello[4]	1928	M 18	Left neck punctured by carriage shaft in fossa	Following day left chylothorax and emphysema. Drained 900 c. c. chyle per day. Well in 5 months	L	Repeated thoracenteses until infected, then rib resection	R	
31 Luermont, Marchet[4]	1930	F	Auto accident; thrown against front seat with chest	Fract. 8-9 ribs left. Fourteen days later chylothorax and sudden onset of dyspnea; oliguria, thirst and emaciation	L	Twenty-two thoracenteses totaling 37 litres. Oxygen and paraffine injected in vein. Rib resection in 12 days	D	No autopsy
32 Andrews[6]	1929	M 52	Crushed by auto	Seven days later sudden dyspnea, etc. Leucocytosis. Methylene blue by mouth appeared in chest. Died in 15 days	R	Five thoracenteses totaling 12 litres chyle	D	Three litres in right chest and small amount in pericardium. Duct perforated by broken arthritic spur

Author	Date	Age and Sex	Nature of Trauma	Clinical Course	Side	Therapy	Result	Autopsy Findings
33 Paitre[7]	1929	M	Struck by auto before eating	Two days later sudden shock. Rt. rib broken in post. axillary line Well in 10 days	L	One thoracentesis 300 c. c. Diet of sugar and champagne with rectal feedings	R	
34 McNab[5]	1932	M 46	Fell and landed on his back	Minor injury. Six days later sudden shock. Died in two months	R	Daily thoracenteses; total 35 litres in 48 days. Thoracotomy on fiftieth day	D	No autopsy
35 Scott[2]	1934	M 37	Crushed by truck	Immediate intraperitoneal hemorrhage. Nineteen days later fairly sudden rt. chylothorax Well in 63 days	R	Immediate thoracotomy. All food by mouth stopped	R	
36 Heppner[3]	1934	F 19	Thrown against front seat in auto accident	Minor injury of forearm. Open reduction 3 weeks later. Five weeks later sudden dyspnea and 9 weeks ascites. Died in 16 weeks	R L and A	Eleven weeks postoperative chylous ascites Repeated thoracenteses and fed chyle	D	Ruptured thoracic duct 2-5 cms. above diaphragm with bil. chylothorax and ascites and bil. hemorrhage of adrenals
37 Lillie and Fox[1]	1935	M 45	Fell from a scaffold	Fract. 10-11 vertebrae and ribs 1½ in. from spine. Fifth day sudden shock. 148-114 lbs. Well in 6 mos.	R	Repeated thoracenteses: total 52,750 c. c. Fat free diet which seemed to stop flow from 4 litres to 250 c. c.	R	
38 Fisher and Shackelford	1930	F 45	Fell 18 feet on back	Minor injury, sent home. One month later gradual chylothorax and ascites. X-ray showed fr. first lumbar vertebra. Well in 3 months	R and A	Repeated thoracenteses and paracenteses	R	
39 Shackelford and Fisher	1935	F 20	Thrown against steering wheel in automobile accident	Minor injury at first and dislocated hip reduced. Eighteen hours later sudden shock Well in 16 months	R	Repeated thoracenteses and paracenteses	R	
40 E. H. Bauersfeld[39]	1937	M 22	Automobile accident	Serious injury. Eight days later massive effusion. Lost weight	R	Repeated thoracenteses 22,275 c. c. chyle given intravenously, 1,000 c c. at a time	R	
41 Huertas[41]	1935	M 39	Train wreck; imprisoned in hyperflexion of spine	Second day developed chylous effusion. X-ray showed no fracture of spine	R	One diagnostic thoracentesis		Patient still had chylous effusion one month later at time report was made

CASES MENTIONED TOO SCANTILY TO BE INCLUDED

Longelot[12]	1663	?	Gunshot wound				D	?
Mauro[12]	?	M	Stab wound of neck					
Petavel[35]	?	?	Crushed by a wagon				R	
Stanly[35]	1894		Struck by a carriage pole	Chylous ascites only	A		R	
Eyer[40 16]	1899		Crushed abdomen					
Munter[41 12]	1899	M	Left neck cut by a hatchet	Drained chyle externally	L	Duct clamped and ligated	R	
Hall and Morgan[23]	1910	M 19	Run over by wagon	Chylous ascites on the thirteenth day. Minor injury at first	A	Rectal feedings, following which it absorbed Multiple paracenteses	R	
Brekke[46 5]	1917							
Drey[48 5]	1920		Gunshot wound of neck		R		R	
Ceelen[8]	1923							
Etienne[4]				Fractured spine			D	Fractured spine with ruptured duct and mediastinal pleura at that point

infected. We also are convinced that chyle will not drain satisfactorily through a tube.

The operative repair or ligation of the duct in these cases was never attempted, due probably to two factors: first, that the patients were poor risks, and secondly, that the approach was too formidable. In wounds of the neck involving the duct, however, each has been successfully performed several times with no mortality.[22 24] Recently, A. L. Brown[40] described an operative procedure for draining an early chylous extravasation before it ruptures into the pleural cavity. It has also been suggested that the duct be ligated below the diaphragm, but after a practice attempt by one of us (R. T. S.) on a fresh autopsy, it was felt that this route is technically too difficult to be practical.

Hall and Morgan[23] suggested that all food be introduced by rectum, the lymphatics of which would drain into the superficial system and circumvent the thoracic duct. This channel of absorption has not been conclusively demonstrated and others have discarded the method as useless, although they have quoted no decisive observations.

In one case[40] the withdrawn chyle was administered orally with temporary improvement, but ultimate death.

One other therapeutic suggestion of merit is the utilization of a low fat diet. This is based upon our partial knowledge of the psysiology of the thoracic duct. In the three cases in which this therapy was used in conjunction with other measures, recovery followed. When used alone, the one patient died. Experimentally, in dogs at least, we have definite but indirect evidence that it might be helpful. One of the most satisfactory ways of locating the duct in an anesthetized animal is to feed this animal a pint of cream 1½ hours before the appointed time, then on operative exposure the duct is more readily seen as it is distended with creamy material. If Scharlach R or sudan III had been added to the cream, the duct is even more easily identified. Thus we know that the feeding of fats increases the volume of chyle, but whether absence of fats will decrease or stop the flow is still problematical. However, we believe the evidence is sufficient to contraindicate the feeding of fats during the leakage of chyle, thus reducing the intraductal pressure and through relative collapse of the vessel encouraging its repair. Should the condition persist sufficiently long to make fats imperative for the preservation of nutrition, these could then be supplied by intravenous re-introduction of the withdrawn, uncontaminated chyle. Bauersfeld[39] recently successfully treated a case by this method, although Oeken's[36] earlier attempt failed. Should the chyle be infected or uncollectable, L. E. Holt's[38] method of administering intravenous fats would be worthy of trial.

Space does not permit in this paper to review the experimental work published on the thoracic duct. Briefly, chyle seems essential for the maintenance of nutrition, and following ligation of the duct sufficient collaterals develop to transport this apparently vital material. The interested reader can refer to the publications of Sir Astley Cooper[18] and F. C. Lee[26] for a fuller discussion of this subject. The latter in particular has made an excellent compilation of the literature in addition to contributing a valuable piece of original work.

In summary, we have presented two cases of traumatic chylothorax which came under our care, and in both of which recovery resulted. We have collected and analyzed the 39 other cases in the literature. Eleven additional reports were discarded due to lack of detailed description. From this analysis we have drawn the following conclusions:

(1) Traumatic chylothorax is very rare.

(2) It can be caused by penetrating wounds, crushing injuries, hyperextension of the spine, or sudden changes in intrathoracic pneumohydrostatic force.

(3) It frequently results from an apparently minor injury.

(4) It can result from a fractured clavicle, ribs or vertebrae.

(5) Generally speaking, a right chylothorax indicates an injury to the thoracic duct at a low level and vice versa.

(6) Without microscopic study of the fluid it may be mistaken for an empyema.

(7) The mortality is high.

(8) The ingestion of fats is contraindicated until the leakage of chyle has ceased.

(9) Repeated thoracenteses is the method of choice to relieve dyspnea, followed by open thoracotomy if the reaccumulations occur too rapidly.

(10) Intravenous re-introduction of uncontaminated chyle is practical and has been successful.

(11) Surgical ligation of the duct is physio-

logically compatible with life, but technically impractical at present.

REFERENCES

1. Lillie, O. R.; and Fox, G. W.: Traumatic Rupture of the Intrathoracic Duct with Chylothorax. Ann. Surg., **101**: 1367-76, 1935.
2. Scott, J. F.: Rupture of Thoracic Duct. Northwest Med., **33**:50-51, 1934.
3. Heppner, G. J.: Bilateral Chylothorax and Chyloperitoneum. J.A.M.A., **102**:1294, 1934.
4. Mouchet, A.: Traumatic Chylothorax with Report of a Case. Jour. de Chir., **42**:386-399, 1933.
5. McNab, D. S.; and Scarlett, E. P.: Traumatic Chylothorax Due to Intrathoracic Rupture of Thoracic Duct. Canad. Med. Jour., **27**:29-36, 1932.
6. Andrews, C. F.: Traumatic Intrathoracic Rupture of Thoracic Duct with Chylothorax. Neb. State Med. Jour., **14**: — (Jan.) 1929.
7. Paitre: Traumatic Rupture of Thoracic Duct with Left Chylothorax. Bull. et Mem. Soc. Nat. de Chir., **55**:813-816, 1929.
8. Grinault: Traumatic Chylothorax, Eight Cases. Bull. of Mem. Soc. Nat. de Chir., **65**:172-179, 1928.
9. Watts, S. H.: Traumatic Chylothorax. Ann. Surg., **74**:691, 1921.
10. Malone, A. E.; and Wardrop, J. G.: Recurrent Chylothorax Following Trauma. Lancet, **1**:1116, 1919.
11. Elliott, T. R.; and Henry, H.: Chylohemothorax from Wounds Involving the Thoracic Duct. Lancet, **1**:872-874, 1917.
12. Zesas, D. G.: Die nicht operative entstandenen verletzungen des ductus thoracus. Deutsch. Ztschr. f. chir., **115**:49-62, 1912.
13. Buchtala, H.: Analyse de punkticus flussigkeit in einen falle von traumatischem chylothorax. Ztschr. f. Physiol. Chem., **67**:42-45, 1910.
14. Campbell, D. G. J.: A Case of Chylothorax (Traumatic). Maritune Med. News, Halifax. **18**:295-7, 1906.
15. Newman, D.: Chylothorax from Rupture of the Thoracic or of One of the Large Lymphatic Ducts. Glasgow Med. Jour., **59**:117-121, 1903.
16. Legg, T. P.: Case of Bilateral Chylothorax Following Injury. St. Barth. Hosp. Jour., **6**:163, 1898-9.
17. Quincke, H.: Chylusergass in serose hohlen Hydrops chylosus. Deutsch. Arch. f. Klin. Med., **16**:121, 1875.
18. Cooper, Sir Astley: Experiments on the Thoracic Duct in Dogs. Collected surgical papers, p. 100, Lea & Blanchard, Philadelphia, 1845.
19. Wallis, R. L.; and Scholberg, H. A.: On Chylous and Pseudochylous Ascites. Quart. Jour. Med., **4**:153, 1910.
20. Wallis, R. L.; and Scholberg, H. A.: On Chylous and Pseudochylous Ascites. Quart. Jour. Med., **3**:301, 1909.
21. Smith, E. D.: Rupture of the Thoracic Duct. Ky. Med. Jour., **26**:198 (April) 1928.
22. Cushing, H.: Wounds of the Thoracic Duct. Ann. Surg. **27**:719, 1898.
23. Hall, E. H.; and Morgan: A Case of Chylous Ascites. Quart. Bull. of Northwestern Univ. Med. Sch., **2**:44.
24. Harrison, E.: Treatment of Wounds of the Thoracic Duct. Brit. Jour. Surg., **4**:304, 1916.
25. Lewin, P. L.: A Case of Chylothorax. Amer. Jour. Med. Sci., **150**:71, 1916.
26. Lee, F. C.: Ligation of the Thoracic Duct. Bull. Johns Hopkins Hospital, **33**:21, 1922.
27. Van Nuys, R. G.: Chylothorax. Calif. & West. Med., **34**: 269, 1931.
28. Funk, E. H.: Chylothorax. Med. Clin. of North America, No. 2, p. 787, 1918-9.
29. Hammesfahr, A.: A Case of Bilateral Chylothorax. Munch. Med. Wchnschr., **54**:1876, 1907.
30. Lindenberg, F.: Bilateral Traumatic Chylothorax. Munch. Med. Wchnschr., **73**:1798-9, 1926.
31. Kirchner: Ein fall v. rechtsectigen chylothorax in folge v. ruptur des ductus thoracus. Arch. f. Klin. Chir., **32**:156-181, 1885.
32. Simone, V.: Ein fall v. rechtsectigen chylothorax: Mitterlingen aus den grenzbeiten der. Med. und Chir., **5**:224, 1900.
33. Derganz, F.: Traumatic Chylothorax. Wien. Klin. Wchnschr., **28**:1320, 1915.
34. Weisinger: Traumatic Chylothorax. Deutsch. Med. Wchnschr., **24**:231, 1898.
35. Handmann: Two Cases of Chylothorax. Munch. Med. Wchnschr., **46**:181, 1899.
36. Oeken: Chylothorax. Munch. Med. Wchnschr., **55**:1182, 1908.
37. Port, K.: Traumatic Chylothorax. Deutsch. ztschr. f. chir., **39**:572, 1894.
38. Holt, L. E.; Tidwell, H. C.; and Scott, T. F. McN.: Intravenous Administration of Fat. Jour. Ped., **6**:151 (Feb.) 1935.
39. Bauersfeld, E. H.: Traumatic Chylothorax. J.A.M.A., **109**: 16-18, 1937.
40. Brown, A. L.: Traumatic Rupture of Thoracic Duct. Arch. Surg., **34**:120-4, 1937.
41. Bravo, J.; Diaz-Canedo; and Huertas, A.: Quilotorax traumatico. Med. Ibera, **29**:379, 1935.
42. Gronlund, Lars: Ett Fall au chylothorax. Finska Lak sallak handk., **76**:439, 1934.
43. Lindstrome: Van Temkinzehut Inaug.-Diss. Berlin, 1909.
44. Slajmer: Zentralblatt f. chir., No. 8, 1912.
45. Bohne-Lowenstein: Zeitschr. f. chir. Bd. 87.
46. Brekke: Med. Rev. Bergen, **42**:78-80.
47. Lindenfeld: These de Zurich, 1919.
48. Drey: Maratschr. f. Unfallheilk., **27**:241, 1920.

DISCUSSION (*Abstract*)

Dr. Rawley M. Penick, Jr., New Orleans, La.—I have been very much interested in this report of two cases of traumatic chylothorax. Of particular interest to me were the authors' views on the mechanism by which rupture of the duct is produced. As they point out, it is probable that a rupture of a subpleural accumulation of chyle into the pleural cavity explains those cases having sudden collapse some hours after the injury. However, it is difficult for me to believe that pneumohydrostatic pressure plays a direct part in causing the primary rupture of the duct. The thoracic duct has usually more than one termination leading into the venous system and the only other factor that might retard outflow temporarily is venous pressure, which is easily overcome. Kinking probably does not play a part. It must also be remembered that the valves are not efficient and therefore any pressure applied to the duct would cause a rapid outpouring above as well as some retrograde movement. Under such conditions it is difficult to see how enough pressure can be built up to cause rupture, particularly when the pressure is everywhere evenly applied as hydrostatic pressure is. I have often thought that injury to the duct might occur by traction on one or more of its branches, produced by a dislocation of the tissues. This could cause a tear at the junction of the branch. This, however, is only a surmise and it must be granted that the exact mechanism remains obscure in most instances.

This report should sharpen our clinical judgment in treating common injuries to the chest. Perhaps we have been too prone to apply a rule of thumb and treat all of these cases conservatively, for there certainly are numerous conditions associated with trauma to the chest which require more radical treatment. It is, therefore, important that in treating these patients we keep in mind those lesions which endanger life and require more than conservative treatment.

Dr. Frank K. Boland, Atlanta, Ga.—We have had cases of hydrothorax, pneumothorax, hemothorax, and now Dr. Shackelford gives us an interesting discussion concerning chylothorax. I have had no case of this kind, but should like to introduce the youngest member of the thorax family, bilithorax. This condition occurred in a Negro man, who fell from a box car, striking his abdomen on a steel rail. He was unconscious for a few minutes, was then taken home and was not sent to the hospital for three weeks. He complained of pain in his left chest and noticed a swelling just below the costal margin on the right side, which became progressively larger.

On admission to the hospital the patient was very

sick. His abdomen presented a circumscribed, soft, fluctuating mass to the right of the epigastrium, five inches in diameter. Percussion revealed absolute flatness in the right chest, the heart being displaced far over to the left side. Aspiration of the right chest produced bile which was viscid and unmixed with blood, suggesting that the bile came from the gallbladder and not from the liver. The abdominal mass was incised and bile escaped. Later empyema developed and was drained by rib resection. The fluid used to irrigate the empyema cavity came through the abdominal wall. Later a ventral hernia resulted and was repaired. The Negro made a complete recovery and is now doing his usual work.

Dr. Shackelford (closing).—As was suggested, autotransfusion of the contents of the chylothorax might be utilized, and has been. However, all strings of coagulum should be removed from the withdrawn chyle before reinjection. These coagulated bodies and the possibility of infections are, to me, the only dangers of this helpful form of treatment. Dr. Penick's suggestion that traumatic chylothorax is probably caused by tearing off of the collateral branches from the main trunk of the thoracic duct is well worth considering and indeed offers a very plausible explanation for the lesion and one which had not previously occurred to me. One of my colleagues had a case of bilithorax like Dr. Boland's, which followed an automobile accident. The patient was a young woman and the trauma had ruptured her liver, which was promptly packed on admission to the hospital. She subsequently developed a right bilithorax and died. An autopsy showed that an accumulation of bile had apparently occurred above the liver. It had eroded through the diaphragm during the several weeks of her illness and burst into the right pleura with subsequent death.

GAS GANGRENE INFECTIONS IN INDUSTRIAL PRACTICE*

WITH ESPECIAL REFERENCE TO INFECTIONS FOLLOWING COMPOUND FRACTURES AND OTHER ACCIDENTS

By CLINTON H. RAMSEY, M.D.
Laurel, Mississippi

In the pre-Listerian days of surgical practice, the problem of gas gangrene was a serious one, and many surgeons considered it the inevitable consequence of extensive injury to tissue. With the introduction of antiseptic practices by Lister and aseptic technic by Halsted, however, such infections became comparatively infrequent, and it was not until the World War that the problem again assumed paramount importance in the treatment and care of wounds.

The high incidence of gas gangrene in the early part of the war prompted careful bacteriological studies on the etiological agents involved. These investigations indicated that anaerobic spore-forming bacteria were invariably present in this condition and that *Clostridium welchii* (*B. perfringens*) was the chief offender, being present in 77 per cent of a series of cases studied by two French investigators, Weinberg and Seguim. Next in frequency were *Vibrion histolyticies* and *Clostridium oedematiens, Clostridium histolyticus* and *Clostridium fallax.* During this period of renewed interest in anaerobes, two American workers, Bull and Prichett, demonstrated that *Clostridium welchii* not only causes destruction of tissue by invasiveness and the evolution of gas, but that it also produces a very powerful exotoxin. This toxin was found to be neutralized by an antitoxin produced by the hyperimmunization of animals. Since then it has also been shown that the other anaerobes likewise produce exotoxins, which in turn are neutralized by specific antitoxins.

In industrial practice, the incidence of gas gangrene is comparatively infrequent, but because of the rapidly fulminating character of the infection and its grave prognosis, where it does occur, the physician or surgeon must act promptly and effectively in order to block the progress of the disease.

Gunshot wounds and compound fractures offer the most favorable environmental conditions for the development of *Clostridium welchii* or other spore-bearing anaerobes, since damaged muscle tissue is the perfect medium for the growth and development of these organisms. Boland regards gas gangrene as the most serious complication of compound fractures. In 80 compound fractures in negro patients at Grady Hospital in Atlanta, Georgia, during the 7 years from 1922 to 1929, gas gangrene developed in 15 cases. During the same period the disease was recorded in 5 other cases, not compound fractures. Among 97 cases of compound fractures treated in the white division, seven developed gas gangrene.

In 1932, Millar[1] reviewed the case reports of 607 gas gangrene infections in industrial practice. Two hundred twenty-seven cases were the result of complications following fractures, of which 143 were compound fractures. Other accidents responsible were:

Gunshot wounds	58 cases
Vehicular accidents (exclusive of railroad)	53 cases
Railroad accidents	25 cases
Falls	45 cases

Weintrob and Messeloff reported a detailed study of 85 cases of gas gangrene occurring at Bellevue Hospital in New York City, from 1911

*Read in Section on Railway Surgery, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30–December 1-2-3, 1937.

to 1926, with a mortality of 45.9 per cent. Twenty-six cases were infections following compound fractures, 17 followed lacerations and 6 followed extreme multiple injuries.

Recent reports by Warthen,[2] Ghormley,[3] Stone and Holsinger,[4], Veal,[5] and Bates[6] likewise show that compound fractures rank first as the predisposing factor in gas gangrene, gunshot wounds second, and crushing injuries third.

PROPHYLAXIS AND TREATMENT WITH GAS GANGRENE ANTITOXIN IN INDUSTRIAL PRACTICE

There is a general agreement among surgeons that the first principle of treatment of gas gangrene is a matter of prophylaxis. In this connection the proper surgical care is the most important factor. The circumstances of each injury should be carefully inquired into, and debridement or the removal of dead tissue, or amputation, as the condition warrants, should be practiced. Such cases require unremitting care on the part of the physician, and once the infection has developed, according to Veal,

"half way measures have no place in the treatment of this condition. If amputation is done, it must be well above the involved area. If incision and drainage be done, the incisions must be multiple and the drainage adequate for the discharge of the toxic secretion and the introduction of air. If debridement be chosen, it must be continued until healthy muscle is reached, as evidenced by color, free bleeding and contractility."

The therapeutic use of gas gangrene antitoxin was introduced toward the end of the World War and received such favorable comment and promise that it has also been used in industrial practice more or less extensively. There are a number of isolated case reports in the recent literature. Hospitals and clinics are also compiling their clinical data and some of these reports are now available.

Stone and Holsinger (1934), of the Medical College of Virginia, have reported treating 39 cases with serum in adequate dosage as part of the treatment. Of these 6 died (15.3 per cent). They comment,

"This figure is suggestive of the value of serum as a therapeutic agent."

Warthen, of the Department of Surgery, Medical College of Virginia, has also reported a series of 24 cases of typical gas gangrene, 18 colored and 6 white. Nine did not receive antitoxin; amputation and debridement were practiced. One died. Fifteen cases (since 1932) have been treated with antitoxin; the surgical procedures were less radical. Extensive debridement was done in 13 instances and only 3 amputations. One patient died. Warthen says,

"A comparison with the earlier non-antitoxin cases indicates that these favorable results have been due in large measure to repeated injections of therapeutic doses of gas gangrene antitoxin. Prophylactic injections are not always preventive, but appear to be of definite value even in the case which subsequently develops gas gangrene."

Bates, of the surgical service of the University of Iowa, reports (1937) on the treatment of 32 cases of gas gangrene. Sixteen cases occurred from 1926-1932 and received no antitoxin. The mortality was 80 per cent. Sixteen cases occurred from 1932-1936. These cases received gas gangrene antitoxin therapeutically; three died (18 per cent). He emphasized that the smaller mortality rate can not be attributed to a change in surgery, since the surgical procedures and methods have not changed. In the second group, one case developed gas bacillus infection despite a dose of prophylactic serum, but recovered.

Veal, of the Department of Surgery, School of Medicine, Louisiana State University, has reported the results in a series of 80 cases and has given the mortality in relation to the use of antitoxin in the following table:

	Cases	Deaths	Per Ct.
No prophylactic dose	27	13	48.1
Prophylactic dose	27	2	7.4
No prophylactic or therapeutic dose	5	4	80.0
Prophylactic or therapeutic dose	49	10	20.4

His concluding paragraph is as follows:

"An analysis of this sort naturally does not show the other side of the picture, the numerous cases in which prophylactic antitoxin was given and in which gas bacillus infection did not develop, though all the circumstances were favorable for its growth. Such results would seem to warrant routine administration of the antitoxin in all suspicious cases, as tetanus antitoxin is used. It must be granted that it is expensive, and whether the expense would be too great for its routine use is a matter that hospital authorities must decide. Of its effectiveness as a prophylactic, however, there can be no doubt, just as its therapeutic value seems equally beyond doubt. It is not a measure that should supersede surgery, but certainly it is one that should complement it. My opinion is that in the prophylactic and therapeutic use of antitoxin, combined with the surgical measures indicated in the individual case, lies

the solution of the problem of the shocking mortality which hitherto has seemed inseparable from gas bacillus infection."

REFERENCES

1. Millar, William M.: Gas Gangrene in Civil Life. Surg., Gyn. & Obst., **54**:232, 1932.
2. Warthen, Harry J.: Gas Bacillus Infections: A Study of the Incidence, Treatment and Mortality. Va. Med. Monthly, **62**:275, 1935.
3. Ghormley, Ralph K., of Mayo Clinic: Gas Gangrene and Gas Infections. Jour. Bone & Joint Surg., old series 32, n. s., **117**:906, 1935.
4. Stone, C. S., Jr.; and Holsinger, H. B.: Diagnosis and Treatment of Gas Bacillus Infection. Va. Med. Monthly, **41**:200, 1934.
5. Veal, J. Ross: A Study of Gas Bacillus Infection, with Special Reference to Its Occurrence in the Negro. New Orleans Med. & Surg. Jour., **89**:432, 1937.
6. Bates, Maurice T.: Gas Gangrene. Ann. Surg., **105**:257, 1937.

DISCUSSION (*Abstract*)

Dr. O. B. Zeinert, St. Louis, Mo.—I concur with Dr. Ramsey that the prophylactic treatment is most important and that the combined tetanus-gas antitoxin should be administered in all wounds potentially infected with gas bacilli. In severe lacerations of the soft tissues, complicated by mutilation and compound fractures, a general anesthetic is administered; the fractures are reduced without internal fixation, the wound explored, debrided and irrigated with normal saline solution. A primary closure is made if the wound is seen within six hours. After six hours the wound is drained.

The diagnosis is not difficult and is characterized by pain, temperature, elevation of pulse, swelling, crepitation, foul odor, the roentgenological demonstration of gas in the tissues and positive smear and culture from the wound.

Treatment consists of immediate intravenous administration of polyvalent gas antitoxin followed by intramuscular injection within a few hours; and by prompt surgical treatment. If the wound involves the trunk multiple incisions are made; if it is a localized subcutaneous infection of a limb, multiple incisions are made; if a localized infection of a muscle, a debridement and excision of this muscle is performed; if the infection is very extensive, a guillotine amputation into healthy tissue is indicated. Dressings of Dakin's solution, potassium permanganate, hydrogen peroxide and zinc peroxide are used. The zinc peroxide is nontoxic and oxygen is gradually liberated in the tissues.

As to mortality and incidence, the Surgeon General reports that in the A. E. F. 128,265 wounds were complicated by 25,272 fractures. Of these 1,389, or 1.08 per cent, developed gas gangrene with a mortality of 674, or 48.52 per cent.

Dr. Harold R. Bohlman, of Johns Hopkins University, reported in the *Journal of the American Medical Association* of July 24, 1937, a series of three cases of gas gangrene treated with sulfanilamide, antitoxin and surgery with recovery. He believes that sulfanilamide probably has a specific effect on gas bacilli, but the results may be due in part to checking symbiotic growth with the streptococcus.

Dr. James F. Kelley and Dr. Arnold Dowell, of Creighton University, have recorded encouraging results with roentgen therapy.

I discussed this subject with Dr. Sherwood Moore recently and he has the same opinion. Dr. I. H. Lockwood, of Kansas City, is in the audience and I should appreciate his views on x-ray treatment.

While we have been concerned primarily with traumatic cases, I wish to mention that gas gangrene frequently develops following amputation for diabetic and arteriosclerotic gangrene. In such amputations a preoperative injection of prophylactic gas antitoxin should be administered.

Dr. E. Dunbar Newell, Chattanooga, Tenn.—In the Newell Clinic, in Chattanooga, during the past twenty years, we have treated about 40,000 cases of traumatic wounds: simple lacerated wounds, simple contused and lacerated wounds, badly contused and lacerated wounds, mangled wounds, compound-comminuted fractures, explosion and gunshot wounds. Many of these wounds were soiled and contaminated with dirt and human and animal excrements. Despite this large number of traumatic wounds, we have had in all this series only three cases of gas gangrene. We feel that the reason that we have not had more cases of gas gangrene is that our experience in the evacuation hospitals, in France, during the war taught us the value of thorough debridement, both as a prophylactic and as a curative factor. In all of our cases since the war we have practiced painstaking debridements in wounds where the tissues were devitalized or necrotic, and, especially so, where the wounds had been soil-contaminated and circulation had been impaired. For the past ten years we have been using the prophylactic polyvalent gas bacillus serum on all patients whose traumatic wounds were contused and macerated and soil-contaminated. This may have been a real factor in preventing gas gangrene in our cases, since in 40,000 cases of traumatic wounds only three cases of gas gangrene have developed. However, there may be other reasons, for in about one hundred major amputations for diabetes and Buerger's disease, gas gangrene has not followed; whereas, Eliason reports an incidence of 6.7 and 10 per cent of gas gangrene for such amputations at the University of Pennsylvania and Philadelphia General Hospitals.

There is much medical confusion now about gas gangrene. We know that all bacilli that grow in the absence of oxygen and form spores are grouped in the genus Clostridium and that there are about one hundred in this group. It is the *Clostridium welchii* or *Bacillus welchii* that is the pathogenic organism in the great majority of the severe gas bacillus infections. Reeves says that approximately 30 per cent of the cases treated as *Clostridium welchii* gas gangrene are caused by other anaerobic organisms, and that this 30 per cent of cases should be classed as putrefactive gangrene and treated conservatively by systematic, supportive treatment, debridement and irrigations. *Clostridium welchii* antitoxins are not indicated and may be injurious. Putrefactive gangrene is likely to occur in persons past 50 who are constitutionally below normal.

The early diagnosis is difficult. Eliason says:

"The almost universal incidence of the organism makes a purely bacteriological diagnosis of gas gangrene unreliable. For example, Roberts, Johnson, and Brickner were able to cultivate it from the skin of 21.7 per cent of unprepared abdomens; 8.5 per cent of knife blades

used in making skin incisions, and in 9.2 per cent in the peritoneum when opened for non-inflammatory conditions. One sees, therefore, that the finding of the Welch bacillus *per se* is meaningless."

One must always think of the possibility of gas gangrene when treating a mangled devitalized wound, as this is the most important of all factors in gas gangrene. It is more likely if the wound is grossly soiled, but possible without soiling, as the organisms may be present in from 25 per cent to 100 per cent of all wounds. This condition, plus watchful expectancy of gas gangrene, plus sudden severe pain in the wound with fast pulse, a brownish discharge, and an abnormal wound odor will indicate early gas gangrene.

Davis, of Chicago, has long been an advocate of the x-ray as an aid to the diagnosis; it may help, or it may be misleading, but if convenient, it should be used. If you are thinking of gas gangrene, the diagnosis should be made before gas bubbles are found and before crepitation is felt.

Prophylactic polyvalent gas gangrene antitoxin should be given for three successive days in bad cases, avoiding anaphylactic reactions. Following complete debridement, use Dakin's solution, hydrogen peroxide, or one to five hundred potassium permanganate. The general opinion is that it does not make much difference which one of these solutions is used. Massive doses of antitoxin, 50,000 to 100,000 units, seem to be very effective in some cases. X-ray treatment is being used both for prophylaxis and as a curative agent, and it has many ardent advocates. When the main blood supply of a limb is destroyed and the collateral circulation is weak, amputate at the very first symptom of gas gangrene; do not hesitate, as these patients often die within twelve to twenty-four hours of a fulminating type of gas gangrene despite amputation, heroic serum, x-ray therapy, and blood transfusions.

Dr. James W. Davis, Statesville, N. C.—We have been accustomed to using a combination of perfringens and tetanus antitoxin in all cases where there is danger of contamination from these organisms.

For the past few years, for the prevention of gas bacillus infection, we have been giving an x-ray treatment, which is probably the most useful of all, so far as the prevention of gas bacillus infection is concerned. X-ray treatment, it seems, will prevent gas bacillus infection, or at least it is our belief that it destroys these organisms very readily. In all hand injuries, or other injuries where there is a suspected possibility of gas bacillus infection, x-ray treatment should be given. For years we have been giving routine x-ray treatment in all cases of suppurative appendicitis where there is a possibility of complication by the gas bacillus. It is my opinion that this has greatly reduced our mortality in suppurative cases of appendicitis.

In the treatment of gas gangrene infection, the x-ray is almost a specific. Deep therapy is not necessary. Treatment can be given with an ordinary radiographic tube if necessary but, of course, a broad focus treatment tube would be more satisfactory. Many amputations can be prevented and many lives saved by the early treatment of gas bacillus infection with the x-ray.

RECENT ADVANCES IN BLOCK ANESTHESIA*

By CHARLES BROWN ODOM, M.D.†
New Orleans, Louisiana

During the past five years more strides have been made in anesthesia than in any other branch in medicine. Much of this progress has been in the field of block anesthesia. Physicians have learned to apply facts about the nervous system, which they have known for years, to the problems of this art. Hand in hand with this application of the principles of neuro-anatomy have come new and safer drugs with definite dosages and methods for administration. Because of this, most operations today can be successfully and satisfactorily accomplished with one of the methods of nerve block including local, spinal and epidural.

The day has passed when just anyone can administer an anesthetic and this is just as true in regard to block anesthesia as it is of those drugs affecting the central nervous system. Physicians are realizing that a definite scientific background with a knowledge of neuro-anatomy coupled with an understanding of the dosage and toxicity of the drugs employed are necessary for the serious business of administering any anesthetic. Many of the shackles which have bound block anesthesia and caused criticism of its use within the profession as well as among the laity have arisen through the abuse of the method by those who have had no training or possess no real knowledge of its proper application. The ease with which a block anesthetic can be administered has made it very vulnerable to abuse. Strangely enough, when the novice does get a reaction he is the first to condemn the method, thus shielding his own incompetence and satisfying his ego.

In spite of these shackles, strides have been made in block anesthesia and last year at Charity Hospital at New Orleans over 54 per cent of the 20,000 operations were carried out under this method. The percentage for the same period at the Lahey Clinic in Boston was even higher.

Local.—The most widely used and safest of all forms of block anesthesia is the simple infiltration or local block technic. There are sev-

*Read in General Clinical Session, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

†Senior House Surgeon, Charity Hospital of Louisiana.

eral drugs now used for this method. Of these, procain hydrochloride is most used and probably is the safest. It is a colorless crystal soluble in equal parts of cold water, and in 1:30 concentration in alcohol. The aqueous solution is neutral and may be sterilized by boiling. It is rapidly destroyed by the liver after it enters the circulation. As much as 200 to 300 c. c. of 1 per cent solution has been used for infiltration in major operative procedures with no untoward effects. Epinephrine, 5 drops to the ounce, is usually added to prolong the effect of the procaine by causing a vaso-construction in the area infiltrated. While procaine hydrochloride is probably the least toxic of the anesthetics now in use, it has certain deficiencies, one of which is its inability to furnish good surface anesthesia. As a result, other drugs have been synthesized. Of these newer agents metycaine is the most promising. It is capable of producing surface anesthesia and has a more prolonged action than procaine. It is used in solutions of concentration corresponding to procaine hydrochloride and having approximately the same toxicity.

Recent experimental work reports the discovery of another local anesthetic, d-aminophenyl oxazoline, which is one-half as toxic as procaine hydrochloride and is not a cocaine derivative. But it has not as yet been given a sufficient clinical trial and cannot be obtained in the commercial market.

Use in Fractures.—The numerous uses of local anesthesia in major and minor surgery are well known to many of you and several books have been written on the subject. However, there are two applications of this method developed in recent years which have given results far superior to anything previously devised. The first is its use in the reduction of fractures. There are two reasons for an anesthetic in these cases: the first is the relief of the severe pain produced by manipulation, and the second is relaxation of voluntary and involuntary muscle spasm. This type of anesthesia admirably satisfies both of these points as well as affording numerous other advantages which no other anesthetic can boast. On the other hand, the disadvantages of the use of general anesthesia in these cases is readily apparent. Practically all fracture patients have food in their stomachs which they will readily vomit if a general anesthetic is administered. This is not only messy and uncomfortable, but makes aspiration possible. The reaction will often be severe enough to require hospitalization of the patient. Then again, a general anesthetic cannot be safely given in a darkened fluoroscopic room, where all fractures should be reduced whenever possible. There is not only the danger of explosion from sparks igniting explosive anesthetic gases, but if the room is dark enough for effective fluoroscopic examination it is too dark for the anesthetist to watch the patient's reactions. Concurrent illness such as colds also contraindicate general anesthesia.

In addition to overcoming these disadvantages, local anesthesia has a number of advantages, including a lower mortality rate, less shock, particularly in elderly people, the freedom from post-anesthetic reaction, ready availability and an easy application of the method; and, greatest advantage of all, the long duration of the anesthesia, making proper manipulation under the fluoroscope possible, followed by application of the splint and x-ray check-up. If the position is not perfect, the splint may be removed, the bones reset and another splint applied without the necessity of repeating the anesthetic. Many a poor reduction has been allowed to remain because the physician in viewing postoperative x-rays has decided it wiser to allow the malposition to remain than to risk a second general anesthetic.

However, the method is applicable only in fresh fractures where there is a fluid hematoma which can be injected. The method should never be used in the case of compound fractures or if there is overlying infection of soft tissues. The strictest asepsis should always be observed.

The technic is simple and is as follows: the area over the fracture is thoroughly cleansed with ether, painted with an organic mercurial and screened with sterile towels. Then using a small hypodermic syringe a small skin wheal is raised over the fracture. Through this wheal a 22-gauge needle is introduced, attached to a 10 c. c. syringe filled with 2 per cent procaine hydrochloride, into the hematoma which always occurs at the site of a fresh fracture. The needle is slowly inserted until bony contact is made. The plunger of the syringe is then slowly pulled back. If the needle is in the hematoma blood will be aspirated. If blood is not aspirated the position of the needle is altered slightly until this is accomplished. The blood from the hematoma can be differentiated from venous or arterial blood by the presence of fat globules

which will rise through the novocaine and form a film on its surface. When one is sure the needle is in the hematoma, the 10 c. c. of 2 per cent procaine hydrochloride should be slowly injected. The amount will usually be sufficient for Colle's fracture, but larger amounts up to 35 or 40 c. c. may be necessary in fractures of the femur. Anesthesia will appear within five or ten minutes after the injection and manipulation should not be attempted until this time has elapsed. The analgesia will usually last 45 to 50 minutes.

Use in Sprains.—The second recent development in infiltration anesthesia is its use in the treatment of simple sprains. This injury is of great economic importance because of its frequent occurrence and the former unsatisfactory method of treatment. The old method consisted of immobilization, complete rest, and elevation of the injured part. Such therapy usually involves an average period of disability of from three to six days. This new method was discovered by Professor Leriche of Lyons, France, in 1934, and gives immediate and lasting relief. Leriche's theory is that

> "In articular traumatism there is no lesion of the ligaments *per se*, but rather of the nerve endings in these ligaments. These terminal twigs are the sensory origin of the reflex that ensues, acting on the articular trophism and on the vascularization of the motor muscles. The rationale of the procedure is to block the sensory nerve endings, thus stopping the abnormal excitation. This breaks up the reflex by interrupting the vicious cycle arising from the vasodilatation which in turn has been constantly re-exciting the sensory nerve endings."

For the past four years, Professor Leriche and his associates have treated all uncomplicated sprains successfully by this method. Numerous other reports of its successful application have come out of clinics in this country. In the accident room at Charity Hospital our results with the method have been very gratifying and I feel it should be more widely used. Nevertheless, it must be noted that this method is successful only in uncomplicated sprains and in doubtful cases x-rays should always be made for possible fractures. The method will work in a great majority of cases, however, and when it does the results are spectacular. There is immediate relief from pain and soreness. Normal functional use of the joint is restored and a patient with a sprained ankle will be able to walk when formerly he was unable to place his foot to the floor. There is rapid disappearance of edema and a very grateful patient is the result.

The treatment, which is simple, must include the cooperation of the patient to be successful. The area over the affected joint, which in my experience has usually been the ankle, is prepared by thoroughly cleansing with ether and then painting with mercurial. The field is then screened with sterile towels. Strict asepsis is imperative. Using a 1 per cent solution of procaine hydrochloride and a hypodermic needle a skin wheal is raised over the injured ligament. In the case of the ankle this is usually the external lateral ligament which is traumatized by violent inversion of the foot. Through this wheal a 25-gauge needle attached to a 10 c. c. syringe filled with 2 per cent procaine hydrochloride is inserted. The procaine solution is then slowly injected into the peri-articular region, care being exercised that the injection is not made into the joint. Usually the 10 c. c. of solution will be sufficient to give complete relief of pain and the patient should begin walking immediately. The edema will subside within a few hours. Should the pain return, the ligament should be reinjected on the following day. In very few instances will this be necessary as one injection is usually sufficient. The patient may subsequently complain of a slight pain at the site of injection due to the needle puncture, but this can be minimized by the use of a small gauge needle and by restricting the operation to a single puncture. A small dressing should be applied over the puncture wound to prevent infection.

Spinal Anesthesia.—One of the most useful forms of block anesthesia is spinal, but unfortunately it has inherent in itself certain elements of danger. For many years the chief bugbear in this type of anesthesia has been the fear of fatality due to respiratory paralysis and the drop in blood pressure which occurs with its use. The blood pressure fall can be combatted, at least in part, by the preoperative administration of ephedrine, and in recent years there has been a steady advance in perfecting the method until at present, in the hands of one skilled in its use, the mortality rate is extremely low. On the whole, the advantages of spinal anesthesia seem far to outweigh its disadvantages. Its value in abdominal surgery cannot be exaggerated because of the marked relaxation it produces.

It is not the purpose of this paper to discuss the uses and abuses of spinal anesthesia, but rather to draw your attention to the need of becoming well acquainted with recent advances

in the technic and proper uses of newer drugs. Anyone who administers a spinal anesthetic should have a thorough understanding of the following points: (1) a knowledge of the anatomy and hydrodynamics of the spinal canal; (2) a knowledge of the volume control and specific gravity methods for governing the anesthesia; (3) the proper site for injections; (4) the proper rate of injection; (5) the dosages of drugs used; (6) ways and means of combating reactions when they occur. The further application of these principles and the search for a drug of longer action and lower toxicity will speedily bring about a more widespread adoption of this method by its proponents and opponents. Some progress has been made in the latter respect, but the ideal drug for this procedure has yet to be discovered. Procaine hydrochloride crystals, novocaine, have proven a boon to spinal anesthesia and have helped pull it back from the depths to which it had sunk due to the use, in its earlier days, of cocaine and various other toxic agents which have been discarded. While the use of procaine hydrochloride crystals is safe, when a dose of 1 mg. per pound body weight is not exceeded and provided certain contraindications are recognized, the anesthesia produced by this drug will usually not last over one hour.

Metycaine, a recent addition to the drugs used in spinal anesthesia, like procaine is a cocaine derivative. It has the same toxicity as procaine when injected intradurally, but the analgesia lasts approximately one and one-half times as long. The dosage is the same as that of procaine hydrochloride.

Pontocaine, another recent addition, is also a cocaine derivative. It is six to ten times as toxic as procaine hydrochloride, but only one-tenth the dosage is required. The drug is supplied in a 1 per cent solution which has a specific gravity of 1.0068 at 25° C. Under normal conditions the specific gravity of spinal fluid varies from 1.001 to 1.009, therefore since the pontocaine solution may be lighter or heavier than spinal fluid, it is necessary when using the volume control technic first to determine with a test solution whether the solution to be injected is lighter or heavier than the spinal fluid. Without this knowledge the height of anesthesia cannot be properly controlled. A spreading to the medulla may occur with resulting respiratory paralysis. Dr. Sise has overcome this objectionable feature by weighing the pontocaine solution with 10 per cent glucose solution and running it into the desired position in the spine by means of gravity. This technic is applicable when the patient is in the level or Fowler's position, but cannot be used when the Trendelenburg position is utilized. To obtain satisfactory results with this method, strict adherence to the rules for its administration must be followed.

DOSES OF PONTOCAINE FOR ADULTS

Anus, 7 to 8 mg.
Perineum and bladder, 12 to 14 mg.
Legs and pelvis, 13 to 15 mg.
Lower abdomen, 16 to 18 mg.
Upper abdomen, 17 to 20 mg.
The pontocaine solution is diluted with 2.5 to 3 c. c. of 10 per cent glucose.
The anesthesia will last approximately two hours.

Nupercaine is a long-time anesthetic, and while it is twenty times as toxic as procaine hydrochloride, only one-twentieth the dose is used, and because of its high dilution it may be less toxic. It is a crystalloid which is freely soluble in water or salt solution. In aqueous solution the specific gravity is less than that of spinal fluid and as a result it will rise above the spinal fluid. W. Howard Jones has devised a method of obtaining spinal analgesia using 1-1500 solution of nupercaine in 0.5 per cent sodium chloride solution. Because such large quantities of solution are used, it must always be warmed to body temperature (98.6) to prevent shock when injected into the spinal canal.

TABLE OF DOSAGE

6 c. c. of 1:1500 solution of nupercaine	12 D down
10 c. c.	10 D down
12 c. c.	7 D down
15 to 18 c. c.	D2 and D5 down

The solution is injected at the level of the second lumbar interspace with the patient lying on one side. Following the injection, the patient is turned on the abdomen to place the nupercaine in contact with the sensory nerves for a stated interval, then is turned to the supine and horizontal position to block the motor nerves. This method has utilized the natural curves of the spinal canal to pocket the analgesic solution in the convexities of the dura. The method furnishes a prolonged period of anesthesia up to two to four times as long as procaine, but one must be well grounded in its use for it is potentially dangerous.

In spinal anesthesia at the present time novocain or procaine, metycaine, pontocaine and nupercaine all have their place. Procaine hydro-

chloride should be used in procedures expected to last less than one hour, metycaine in those lasting less than one and one-half hours, pontocaine in those lasting less than two hours, and nupercaine in those lasting over two hours. To use a drug, which produces longer anesthesia than is needed for the particular procedure in hand, unnecessarily jeopardizes the life of the patient.

Epidural Anesthesia.—A very important addition in recent years to block anesthesia is epidural. It has many of the advantages of spinal anesthesia and has few of its disadvantages. For the past two years I have employed this method in selected cases and have had excellent results. Particularly useful is this type of anesthesia in patients who are poor risks for spinal or general, but in whom major abdominal surgery is necessary. Most gratifying results have been obtained in cases of incarcerated and strangulated hernias, intestinal obstruction, volvulus and other abdominal emergencies.

The method derives its name from the space into which the anesthetic solution is injected. The epidural space extends the entire length of the spinal canal, ending above at the foramen magnum and below at the coccyx. Its inner wall is the thick spinal dura, its outer wall the lining of the spinal canal. The space is filled with a semiliquid fat and a plexus of veins. Analgesic solutions injected into the space cannot block the spinal nerves within the epidural space because the spinal nerves are covered with dura until they leave the inter-vertebral foramina. However, a block is accomplished by the anesthetic solution leaving the epidural space along the perineural lymphatic and blocking the nerve roots in the para-vertebral region. My results with the method, together with a review of the anatomy, are to be found in other recent papers.

The technic of administering an epidural block requires a certain amount of practice and skill, but if care is coupled with the negative pressure technic, the method is safe. The patient may be seated on the operating table or may lie on one side, depending upon the position preferred by the operator. I prefer to have my patients lie on one side with the back arched. The back is prepared with antiseptic solution and at the second lumbar interspace a skin wheal is raised with 1 per cent procaine hydrochloride solution. Through this wheal an 18 gauge spinal needle is introduced until the point is well engaged in the interspinous ligament. This needle, which I have recently devised, aids materially in the proper administration of the anesthetic and has added to the safety of the technic. The needle has a short bevel to lessen the chances of puncturing the dura, a thumb guard on the shank to make manipulation accurate, and a safety clamp which can be engaged against the skin once the epidural space is tapped, thus obviating any possibility of pushing the needle through the dura during the act of injection. In addition, the needle has two stylets, one of which is exactly the length of the needle, the other one-sixteenth of an inch longer than the needle. This longer stylet can be used as a probe to determine whether the interspinous ligament has been penetrated and the epidural space entered. Attached to this needle is a small glass indicator.

With the needle well engaged in the interspinous ligament, the stylet is removed and the glass indicator is attached. The lumen of the indicator is filled with solution and an assistant arches the spine as much as possible by bringing the chin down onto the chest and flexing the thighs and legs. This causes a stretching of the spinal canal and increases the negative pressure in the epidural space. The needle is then slowly pushed through the interspinous ligament. The instant the needle enters the epidural space the fluid in the indicator will be sucked into the needle because of the negative pressure in the epidural space. The safety clamp is then slipped down the needle until it fits snugly against the skin. Then using a 20 c. c. syringe, the analgesic solution is injected into the epidural space. The solution should be injected slowly and a short time allowed to elapse between each 10 c. c. to allow diffusion of the solution.

The anesthetic solution must be of sufficient concentration to penetrate the thick neural sheaths which exist in the paravertebral region. For this reason the solution must be of slightly higher concentration than that used in local infiltration. My results have been best with a 2 per cent solution of procaine hydrochloride prepared from crystals just before injection. A second consideration of the anesthetic solution is the quantity. This quantity must be sufficient to insure contact with and blockage of all the sensory nerves supplying the operative field.

The dosages which I have found most practical are:

30 to 35 c. c. lower abdominal procedures.
45 to 50 c. c. upper abdominal procedures.

Following the injection of the solution, the patient lies flat upon the table. If the operation is lower abdominal or pelvic, the patient is placed in Fowler's position to facilitate gravitation of the solution downward and blockage of the sacrococcygeal nerves. In upper abdominal surgery the patient is placed in Trendelenburg position to obtain anesthesia of the upper abdominal segment and lower chest. After the injection is completed, the surgeon should always wait 15 to 20 minutes before beginning the operation; for it must be remembered that the anesthetic solution must diffuse around the nerve trunks and then penetrate their thick sheaths before anesthesia is complete. Too early a start before anesthesia is complete may cause the patient to be apprehensive throughout the operation.

When compared to spinal anesthesia, its advantages are readily seen. Bulbar accidents due to respiratory paralysis cannot occur because the anesthetic solution cannot reach the medulla. The blood pressure changes are less marked due to the slow onset of the anesthesia; and motor paralysis is not complete as in spinal. Since the dura is not pierced there is no danger of meningitis or cord injury. The patients are more comfortable and vomit less often than when spinal is used. Post-lumbar puncture headaches, which occur often after spinal, do not occur where epidural is used.

The skill and care necessary for administration of an epidural anesthetic, coupled with the fact that one must wait 15 to 20 minutes for the onset of anesthesia, makes it probable that epidural anesthesia will not be used in busy hospital services. However, in selected cases the advantages of epidural anesthesia far outweigh these objections. In fact, I have seen a number of cases in which it proved a life-saving measure.

SUMMARY

Recent additions to the realm of block anesthesia are presented:

(a) Its use in the reduction of fractures.

(b) Its use in the treatment of simple sprains.

(c) Advances in spinal anesthesia, stressing the proper usages of the newer drugs.

(d) Epidural anesthesia.

SOME MODIFICATIONS OF THE CARDIO-RESPIRATORY TEST OF FROST*

By O. W. BETHEA, M.D.
New Orleans, Louisiana

There is a growing tendency to regard the heart as a whole, rather than to base our conclusions on the presence or absence of isolated details such as murmurs, arrhythmias, changes in rate or in blood pressure. The perfectly normal heart, when the individual is at rest, is doing only about 10 per cent of the work of which it is capable.[1] It is, therefore, carrying 90 per cent of reserve. It is the determination of this reserve in any given case that furnishes the best criterion as to the cardiac status of the patient. I agree with many others[2,3,4] that our best approach to this datum is by means of a carefully made history. The physical examination, laboratory reports, electrocardiogram and roentgenological study are often indispensable aids, but there is also a large field of usefulness for cardiac function tests. Many ingenious and useful suggestions have been made, but the perfect procedure is still for future development.

The bases of the cardiac function tests have been some form of exercise that would make demands upon the heart. Among the various plans suggested have been climbing stairs, hopping on one foot, knee dips, body bends, the use of dumb bells, and so on. The special step designed by Master[5] has much in its favor and his extensive study and excellent presentation of the subject constitute a valuable addition to medical literature. Against most of the measures that have been suggested many questions may be raised. For example, the reaction of the patient to climbing steps will depend very largely upon such factors as his habit of walking, whether he lives in a two-story or a one-story house, whether he uses stairs or an elevator at his place of business, whether he is accustomed to walking on a level or climbing hills. The development of the leg muscles, as from bicycle riding, would materially influence the effort required.

I believe that the best results are obtained by the examiner's becoming intensively familiar with one function test and using that when a test is indicated until "practice makes perfect." Some years ago I selected the cardiorespiratory test of Frost[6] and have become increasingly con-

*Read in General Clinical Session, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

vinced of its value. While there are arguments against the reliability of all cardiac function tests, breathing is one exercise in which all of us are more or less uniformly experienced and there are some other advantages in Frost's test that are certainly worthy of consideration. The equipment is uniform. The same apparatus is used by every one employing this test, no matter where located. The equipment is light, easily transported and may be carried to the patient's home or to the hospital room.

The test can be carried out when the patient is in bed or when he has impaired walking facilities as easily as under any other circumstances.

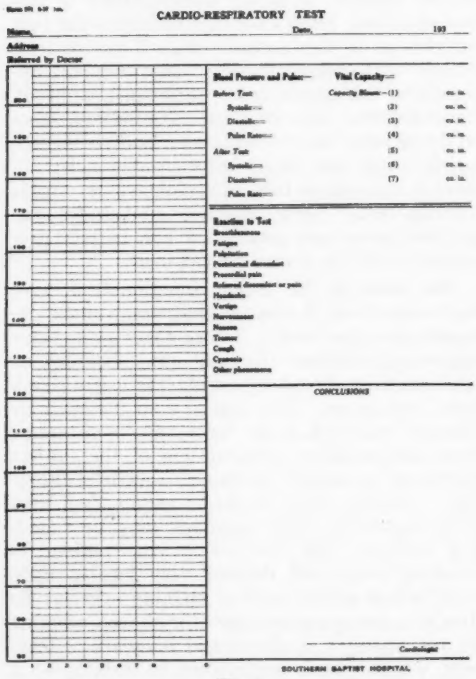


Fig. 1

Reduced illustration of record sheet, regular hospital record size (8½ in. x 11 in.).

BLOOD PRESSURE AND PULSE:— VITAL CAPACITY==

Before Test:
Systolic==130
Diastolic==82
Pulse rate==74

After Test:
Systolic==128
Diastolic==78
Pulse rate==76

Capacity Blown:—(1) 180 cu. in.
(2) 195 cu. in.
(3) 190 cu. in.
(4) 195 cu. in.
(5) 200 cu. in.
(6) 195 cu. in.
(7) 205 cu. in.

Fig. 2

Record of Blood Pressure, Pulse and Vital Capacity

It does not carry the element of possible danger to the patient with a damaged heart as do most of the other function tests suggested. Many a patient whom one would hesitate to have hop on one foot or do body bends or army push-ups may be subjected to this test with impunity.

Since Frost[6] introduced this measure in 1924 it has been used on a large number of patients. Many of these individuals have been given repeated tests during the years following and the results analyzed, especially by the insurance company represented by Frost, until now we have a fairly definite understanding of what

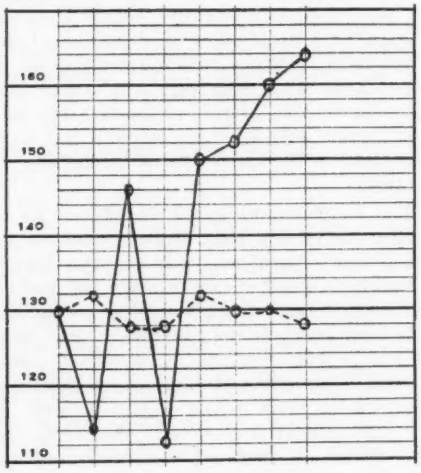


Fig. 3

Normal record of systolic pressure and base line.

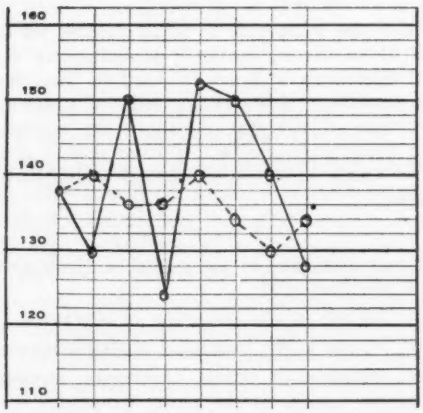


Fig. 4

Reduced cardiac reserve.

Breathlessness	+	Vertigo	+
Fatigue	0	Nervousness	0
Palpitation	0	Nausea	0
Poststernal discomfort	0	Tremor	+
Precordial pain	0	Cough	0
Referred discomfort or pain	0	Cyanosis	0
Headache	0	Other phenomena	0

Fig. 5

Record of Reaction to Test

constitutes a normal record and the significance of deviations. In other words, the record may be read very much as we read an electrocardiogram.

I have gradually deviated somewhat from the original technic of Frost and, while I am not at all sure that I have developed any general improvement, I do feel that I have increased the value of my own results.

The original outfit as devised by Frost is employed. (1) The record form corresponds in size with the regular standard sheets employed in hospital files. The record sheet of Frost seems to have been designed to harmonize with insurance records. (2) Each respiratory effort is made by blowing into the spirometer and the reading in cubic inches recorded. This has the advantage of giving an accurate measure of the cooperation of the patient, and incidentally may secure better cooperation by showing the patient the visible result of his effort. It also gives a more complete record of sustained respiratory capacity. (3) The reaction of the patient during the test is recorded at the termination of the procedure.

As has been explained by Frost, during a forced expiratory effort there is first a fall in the systolic pressure, then a rise which should reach its highest point at or just after the termination of the effort.

The normal heart should send the pressure higher with each of the seven efforts employed in this test. It reminds one of the high jumper on the athletic field who obtains his best results only after a number of attempts. The damaged heart, as would be the case with an impaired athlete, fails to do this, and the stage where the break occurs in the systolic pressure and the degree of the decline are valuable data as to the loss of cardiac reserve. The excellent suggestions of Frost with regard to the type of patient for whom this procedure is inadvisable have been followed carefully. I have not gone into the discussion of the base line and the diastolic pressure, and those interested are referred to the complete discussion of Frost.

I have always arranged that the patient be in a comfortable position whether in bed or in a chair by my office desk. A period of preliminary rest is always given so that the pressure and pulse rate may reach a level. The patient is psychically prepared, as far as possible. Care is exercised that the patient's stomach is not distended with food or the abdomen with gas. I have found it of advantage in securing cooperation to give a brief outline of the test and its objectives. After many years of experience, I have found this test of definite value in a large per cent of the cases where it has been tried, and occasionally it has given invaluable information that was supplied in no other way.

REFERENCES

1. Lewis, Sir Thomas: Diseases of the Heart. New York and London: The Macmillan Company, 1933.
2. Herrman, George: Diseases of the Heart. Oxford Medicine, New York and London. Oxford University Press.
3. Christian, Henry A.: Diseases of the Heart. Oxford Medicine, New York and London. Oxford University Press.
4. Bethea, Oscar W.: Analysis of the History in the Diagnosis of Reduced Cardiac Reserve. The Mississippi Doctor, (Jan.) 1937.
Cardiac Reserve in Relation to Continued Activity. Int. Med. Digest, **26**:240 (April) 1935.
5. Master, Arthur M.: The Two-step Test of Myocardial Function. Amer. Jour. Surg., **10**:495 (April) 1935.
6. Frost, Harold M.: The Response of the Cardiovascular System to Respiratory Exertion. Boston Med. & Surg. Jour., **191**:853 (Nov.) 1924.
Hypertension and Longevity. Boston Med. & Surg. Jour., **193**:241 (Aug.) 1935.
Cardiovascular Function: The Response of the Cardiovascular System to Respiratory Strain as Applied by the Cardio-Respiratory Test. Anesthesia and Analgesia (June) 1926.

FUNCTIONS AND USES OF PSYCHOPATHIC HOSPITALS*

By LAWRENCE F. WOOLLEY, M.D.
Towson, Maryland

Since the first psychopathic hospital was founded at the University of Michigan in 1906, there has been a gradually increasing demand for such units. This has become much accelerated in the past few years and more of these hospitals are being built because there is a growing conviction that this type of hospital represents the best society can offer to the mentally ill. The large and increasing number of these patients constitutes one of the greatest social problems of the present day and probably the most important unsolved problem in the field of medicine. It would seem peculiarly appropriate, therefore, to utilize this opportunity to lay before you an explanation of what a psycho-

*Chairman's Address, Section on Neurology and Psychiatry, Southern Medical Association, Thirty-First Annual Meeting, November 30--December 1-2-3, 1937.

*From the Sheppard and Enoch Pratt Hospital, Towson, Maryland.

pathic hospital may be and of how in its functioning it justifies this growing demand. I believe it can be demonstrated that in communities where no psychopathic hospital is available and there is immediate need for further provision for the mentally ill, the psychopathic hospital offers by far the best investment for available funds.

Psychopathic hospitals have been organized in a variety of ways and from a variety of viewpoints, depending upon the special conditions to be met in the communities which they serve. In 1934, six state psychopathic hospitals were reported by the United States Department of Commerce in its Bulletin, "Patients in Hospitals for Mental Disease." These are found in the states of Colorado, Iowa, Massachusetts, Michigan, New York and Texas. Similar psychiatric units such as the Phipps Psychiatric Clinic at the Johns Hopkins Hospital and the neuropsychiatric unit of the Cook County Hospital in Chicago, have been organized under auspices other than those of the state in a variety of places.

Table 1 gives statistical information regarding the number of beds and the personnel of the state psychopathic hospitals. It will be noted that with the exception of New York State Psychiatric Institute and Hospital where 200 beds are provided, these hospitals have a capacity ranging from 60 to 109. The ratio of physicians to patients in all but one of these hospitals ranges between 1 to 6 and 1 to 9. Nursing personnel, occupational therapists and clerical staff are similarly well provided.

Table 2 shows the movement of population in state psychopathic hospitals. It is to be noted here that these hospitals of small capacity handle a very large number of patients. Michigan with 62 beds, which were full at the beginning of 1934, admitted a total of 182 patients during the course of the year and, therefore, treated within the walls of the hospital 244 patients. Colorado with 80 beds and with 54 patients at the beginning of the year, admitted 816, giving a total of 870 patients treated within the hospital during this time. The figures for the other hospitals show similar tendencies.

All of these hospitals have available in the immediate vicinity general hospital service and reciprocal consultation services and they are all connected as an integral part of the educational system of some medical school.

If one should ask, then, what a psychopathic hospital is it would be defined as a small compact hospital of 60 to 100 beds, as a rule connected with a general hospital, in a medical teaching center, fully equipped for diagnostic

Table 1

ADMINISTRATIVE STAFF AND ANNUAL EXPENDITURES OF STATE PSYCHOPATHIC HOSPITALS, BY STATES: 1934

Personnel and (1) Expenditures	United States	Massachusetts	New York	Michigan	Iowa	Texas	Colorado
Administrative staff	659	138	307	53	56	32	73
Physicians	73	16	25	9	10	4	9
Dentists and pharmacists	5	1	2	—	—	—	2
Graduate nurses	131	14	77	6	12	5	17
Other nurses and attendants	147	33	60	13	10	10	21
Occupational therapists	15	2	8	—	2	1	2
Stewards	7	—	2	2	1	1	1
Clerical employees	78	29	28	7	5	1	8
Other employees	203	43	105	16	16	10	13
Expenditures	$1,222,282	$209,171	$612,280	$83,555	$120,272	$67,590	$129,414
Beds		109	200	62	60	60	78

Table 2

MOVEMENT OF PATIENT POPULATION IN STATE PSYCHOPATHIC HOSPITALS, BY STATES: 1934 (1)

State	On Books at Beginning of Year		Admissions During Year				Separations During Year				On Books at End of Year	
	In Hospital	On Parole, Etc.[1]	Total	First Admissions	Readmissions	Transfers	Total	Discharges	Transfers	Deaths	In Hospital	On Parole, Etc.[1]
United States	616	197	10174	9089	1073	12	10173	5592[2]	4397	184	589	225
Massachusetts	81	49	1924	1417	506	1	1935	1840	80	15	67	52
New York	206	54	977	819	147	11	929	902	13	14	212	96
Illinois	119	....	5597	5403	194	....	5638	1515	4000	123	78	....
Michigan	62	68	182	161	21	....	199	135	61	3	60	53
Iowa	40	26	352	309	43	....	358	279	76	3	36	24
Texas	54	....	326	294	32	....	329	308	16	5	51	....
Colorado	54	....	816	686	130	....	785	613	151	21	85	....

1—Includes all on parole or otherwise absent.
2—Figures include 2 who died while on parole.

and research investigations and with adequate treatment facilities for handling a tremendous number of patients with relatively acute illnesses and whose hospital stay is, on the whole, of short duration. (The average stay at the Colorado Psychopathic Hospital is 30.2 days; at the Iowa State Psychopathic Hospital, 24 days; at the University of Michigan State Psychopathic Hospital, 82 days, and so on.)

The above general survey gives a very inadequate picture of the psychopathic hospital and its work. We can give a fairer exposition of the facts if we concentrate upon one psychopathic hospital and explain what it is actually doing in fulfilling its responsibilities to the community. It will be wise to select for our example a psychopathic hospital in a state where the problems were not so widely dissimilar from those now encountered in the South. The hospitals in New York and Massachusetts, where the psychiatric service in the state hospitals has for years partially fulfilled some of the functions that are best served by a psychopathic hospital unit, would not be very useful examples to us, although many of the things which we have to say would apply equally to them. We select, therefore, a psychopathic hospital which was built in a state where at the time of its foundation the state hospital service was woefully inadequate and the distance from the remote corners of the state was so great that adequate psychiatric help was practically unavailable to many districts.

Actual functions now being fulfilled by this psychopathic hospital should be described under the following headings:

FUNCTIONS OF THE PSYCHOPATHIC HOSPITAL

(1) The treatment of patients
  (a) Prophylactic
  (b) Treatment of acute cases
  (c) Treatment of chronic conditions
(2) Observation of mental cases of all types.
(3) Advisory service to criminal and juvenile courts, correctional institutions, public schools and other community agencies.
(4) Research into causes and methods of treatment of mental conditions.
(5) Teaching: of practicing physicians, medical students, nurses, social workers, school teachers, probation officers and the general public.
(6) Stimulation of the organization of the state for an effective mental hygiene program.

There is no attempt here to list these functions in the order of their importance. Indeed, from the standpoint of ultimate value to society, it is extremely difficult to consider one function as more important than the others.

(1) *Treatment of Patients.*—In the general

survey it was pointed out that the small psychopathic hospitals handled a large number of patients. The figures there give but a poor idea of the actual number seen and treated. *Table 3*

Table 3

TREATMENT SERVICE IN 80-BED PSYCHOPATHIC HOSPITAL (1936)

In hospital January 1, 1936	87	
Total admissions during 1936	882	
Total treated in hospital		969
Deductions		
Sent to state hospital	185	
Readmissions	121	
Total deductions		306
Balance (patients legitimately considered as treatment cases in psychopathic hospital)		663
Out-patient service		
Children	336	
Adults	397	
Traveling clinics	117	
Total		850
Grand total		1513

shows that last year 882 patients were admitted to one 80-bed state psychopathic hospital. Eighty-seven patients were in the hospital at the beginning of the year so that a total of 969 patients were treated within its wards. In addition to this, 336 children and 397 adults were treated in the out-patient department, and 117 patients were examined and treated in travelling clinics conducted by the hospital staff in more remote communities. This gives a grand total of 1,819 patients examined and treated during the 12 months of 1936. Of these, 185 were sent directly to the state hospital and 121 were readmissions. Deducting these, we have a total of 1,513 who were treated either in the hospital or in the community and presumably avoided custodial care at the hands of the state. It is to be kept in mind, of course, that a fairly large percentage of these were patients with mild forms of mental illness that might never have required state hospital care even had the psychopathic hospital not been in existence. However, another very large portion of them were patients suffering from acute serious illness of the maniac depressive and schizophrenic types. Another large portion were patients who were apparently on the verge of developing these more serious mental illnesses. Still another portion were patients suffering from acute or chronic organic disease of the central nervous system including such conditions as general paresis, epidemic meningitis and toxic deliria due to all sorts of causes.

All of these patients are thoroughly and carefully studied from the standpoint of the personal and social history, the present mental and physical status, including such laboratory studies as blood, urine and spinal fluid examinations, and, when appropriate, x-ray, encephalography, bacteriological and immuniological reactions, tests for sensitivity to proteins or any other examination that might shed light upon the condition. Whenever advisable, there are also medical, surgical, neurological, endocrinological, dermatological or other special examinations and consultations. Psychological testing is done from the standpoint of determining the general intellectual level as well as with a view to determining special abilities and limitations.

The hospital, being properly equipped and staffed and intimately connected with a first class general hospital, is able to conduct this type of study thoroughly, quickly and efficiently with a minimum of cost to the patient and to the public.

The staff is accessible to the general hospital service in consultation. By this means neurotic vomiting of pregnancy may be properly controlled, special emotional hazards of operation may be avoided, developing toxic psychoses in medical cases may be detected and prevented, and the psychiatric consultant may be useful in detecting and treating the neurotic element frequently encountered in otherwise ordinary medical and surgical ward cases.

With such studies as this available, it is possible to aim the therapeutic attempt at those factors which are found to be actually present and vulnerable to attack while at the same time the assets of the patient may be mobilized in his rehabilitation and re-establishment as a useful member of society.

Such studies can be carried out in the out-patient department as well as in the hospital and, in the case of the travelling clinics, wherever it is necessary or appropriate, the patients can be sent into the hospital for these studies.

This psychopathic hospital is, and all psychopathic hospitals should be, adequately equipped with staff and accessories to treat any of the

wide range of difficulties encountered in the entire field: malaria therapy in paresis, serum in meningitis, sleep, insulin, metrazol, what not in schizophrenia, hydrotherapy, occupational therapy, and so on, in maniac depressive and schizophrenic cases, suggestion, psychobiological analysis and synthesis in appropriate instances, treatment of the environment by contacts and interviews with the relatives through the physicians or social workers, so that as need arises every available resource may be brought to bear upon the problem in hand.

Much of the work in the out-patient clinic, particularly in the case of children and young adults, is prophylactic in nature. The alleviation of continuous anxiety and insecurity and the correction of states of overdependence, over or under solicitude, unwholesome habits of thinking and acting can be expected in some cases to prevent the development of serious mental disorder which might otherwise occur. Here again consultation is furnished the general hospital dispensary through a liaison physician. His immediate availability for discussion and advice permits the avoidance of long delays in working up cases. Moreover, this facilitates the proper management of the patient in the medical, surgical, neurological, obstetrical, pediatric or other department in which the patient may properly belong by virtue of his primary complaint and physical status.

In treatment of chronic disorders such as arteriosclerosis of the brain, senility, general paresis, chronic encephalitis and similar conditions, it is often possible to devise a regimen of living and to educate and readjust the environment so that many of these patients can be kept for long periods in a state of mental adjustment compatible with continued living in society. When the condition is incipient and mild, the treatment can be carried out in the dispensary. When there are acute and disturbing episodes it is often desirable or necessary to admit these sufferers to the hospital wards until the crisis is passed and for suitable training in the new living habits. For example, under proper physical management and with avoidance of situations precipitating emotional tensions, many patients with cerebral arteriosclerosis may be kept quite well adjusted, and at times may be kept at work in their habitual occupations. The supervision of such patients can be carried on much better in psychopathic hospitals and dispensaries than in any other way.

(2) *The Observation of Mental Cases.*—One of the functions of the psychopathic hospital is the original study of mental patients who present conditions which are apt to be chronic or for which no therapy is at present available, and which must sooner or later be sent to state hospitals. Some psychopathic hospitals have found it necessary to act to a very great extent as clearing houses serving this function primarily. This service also devolves upon the hospital we are discussing, but as can be seen from the figures quoted above, it constitutes by no means the major part of the work done.

Also criminals who plead insanity as a defense may be sent to a state mental hospital for a period of observation. The psychopathic hospital is frequently chosen as the place for these studies.

Needless to say the accumulation of data through careful observation and thorough study of the wide range of abnormal behavior patterns passing through this institution provides a mass of material of untold value from which many useful facts can be gleaned.

(3) The advisory service to criminal and juvenile courts and other social agencies is an extremely important function. After the complete study of the case, definite recommendations can frequently be made as to ways in which society might better handle its anti-social members. Welfare and relief organizations welcome the opportunity for advice and help. The community as a whole escapes the disgrace of sending the mentally ill to jails and reformatories. The harrassed practitioner has a source of information and advice and a place for tiding over emergencies in charity cases.

(4) All of the psychopathic hospitals carry on extensive research projects. Last year one state psychopathic hospital had under investigation 15 problems of clinical importance. In the past it has contributed significantly to research in the treatment of general paresis by fever and chemicals; the treatment of drug addiction by various methods; the study and analysis of motor symptoms; the problems of delinquency and behavior maladjustment in children; and many other important psychiatric problems. At the present time it is also conducting research into the effects of physical and chemical treatment for schizophrenia such as fever, sleep, metrazol and insulin.

(5) The teaching of psychiatry at a psychopathic hospital has many ramifications. Among the formal aspects are the set courses given to

postgraduate students, medical students, nurses, social workers, and so on, and courses of lectures given to the lay public under the auspices of such institutions as the Y. M. C. A., the Parent-Teacher Associations, and other organizations. Informally, much is accomplished through consultation service to the general hospitals, conversations with referring physicians, papers presented at medical meetings, contacts with parents and teachers, and the desensitization of the community to mental illness through the healthy attitude engendered by the mere proximity of a dynamic and effective institution for the furtherance of psychiatric aims.

The teaching of medical students is of primary importance in equipping the new generation of physicians to treat patients as individuals and not as an agglomeration of organs. In all the medical schools in which psychopathic hospitals are available for teaching, the psychiatric courses have been amplified to include courses in the first, second, third and fourth years. These range from pre-clinical studies in psychobiology and psychopathology to clinical service in dispensaries or out-patient clinics and clinical clerkships on the wards. Several schools which lack psychopathic hospitals are forced to rely upon state hospital facilities for teaching purposes. Others are dependent entirely upon the utilization of material in general hospitals in which psychiatric complications can be demonstrated. There are still many medical schools in which contact with psychiatric clinical material is not available to the medical student. It is as absurd to attempt to teach psychiatry without adequate clinical contact with patients as it would be to attempt to teach any other branch of medicine in the same way. When psychopathic hospital facilities are lacking, substitutes may be employed, but these always remain substitutes and can never be as effective as a properly organized unit. This applies also to the training of nurses who, without adequate training in the handling of mental patients, must remain always at a disadvantage in dealing with ill people, whether the illness is primarily psychiatric or not. Likewise the effectiveness of social workers and probation officers is greatly enhanced by some understanding of the problems of the individuals being handled by them. Such social agencies find it easier to get things done with the cooperation of the patient or family when they are adequately grounded in the fundamental causes of human behavior.

Courses of instruction at state teachers colleges may be provided by the psychopathic hospital staff. Such preparation of the teacher is essential if many preventable school problems are to be avoided. The children's clinic and consultation services to schools and social agencies furnish abundant pertinent material so that such courses can be kept in the realm of reality and do not have to deal too much with theory and speculation.

The re-education of the general public in all matters of mental health is of importance and bears fruit in relationship to the psychopathic hospital in the form of an early seeking for help at the first sign of maladjustment. In dealing with obscure illnesses, frequently the laity may seek the psychopathic hospital in preference to the general hospital for study and investigation.

One psychopathic hospital has for years held brief talks by staff physicians to groups of visiting relatives. In this way the families have been educated in the general causes of mental illness and much of the traditional "mind shyness" of relatives has been broken down. Mental hygiene principles have been discussed before parent-teacher groups, Y. W. C. A. gatherings, the Mental Hygiene Society, industrial personnel organizations, schools and churches.

(6) The psychopathic hospital may and often does assume a leading role in the state organization for mental hygiene. With its ramifications throughout the state, by means of its travelling clinics, and contacts with social agencies and with families of patients being treated in the hospital, it is usually fortunately placed. It is therefore a function of the hospital to carry on the necessary propaganda and organization work to produce an effective mental hygiene society. A part of the program should be research into the possibilities of formulating definite rules for mental health, such as have been evolved by public health officers for physical hygiene.

Cost of Psychopathic Hospital Care.—The most frequently encountered objection to psychopathic hospitals is what is considered to be the excessive cost of this care. *Table 4* shows a comparison between state hospital care and state psychopathic hospital care in a typical western state. The cost per patient per day is seen to be something over ten times as great for the psychopathic hospital. It is this wide discrepancy of cost that is so conspicuous in the minds of legislators and others when the topic of building a psychopathic hospital is introduced.

Table 4

STATE CARE OF MENTALLY ILL

CUSTODIAL VS. PSYCHOPATHIC HOSPITALS
Cost of Treatment (Same State)

	Statistics		Excess	
	State Hospital	Psychopathic Hospital	State Hospital	Psychopathic Hospital
(1) Population at beginning of year	3729	87	3642	
(2) Admissions	705	882		177
(3) Total treated	4434	969	3465	
(4) Discharged	198	887		689
(5) Deaths	275	19	256	
(6) Total separations	473	906		433
(7) Approximate average stay	7.88 yrs.*	30.2 days	7.80 yrs.	
(8) Ratio of stay	92.7	1		
(9) Cost per patient per day	$0.538	$ 5.789		$5.251
(10) Ratio of daily cost per patient	1	10.74		
(11) Average total cost of one patient	$1,548.09	$174.83	$1,373.26	
(12) Ratio of total cost per patient	8.85	1		

*Replacement cycle.

It seems hardly fair, however, to take these figures at their face value. In the first place, it is by no means infrequently the case that families who cannot support a relative indefinitely in the state hospital service can assume part or all of the expense of the care in the psychopathic hospital for the relatively short time that patients are there. Further reference to *Table 4* reveals that the average stay of the patient in the psychopathic hospital is 30.2 days and the average stay at the state hospital is something over seven years (the exact average stay cannot be computed because of the long duration of many of these cases, but the replacement cycle should be a fair approximation). It is seen that the average total cost of treating an individual patient is $1,373.27 in the state hospital, whereas for the patient in the psychopathic hospital it amounts to only $174.83. Although it costs ten times as much per day to keep patients in the psychopathic hospital, nevertheless the total cost of custodial care for the average patient would cover the total cost of nine patients treated in psychopathic hospitals. It is felt that this is a much fairer basis of comparison. It should be noted, however, that if we include in the cost of psychopathic hospital care the patients also treated in dispensary, the total cost per individual patient treated drops to $110.39. It must be kept in mind that for the majority of patients included in these figures this represents the only expenditure of the state in their care, whereas for patients in the state hospital of the custodial type the expense goes on, in the majority of instances from year to year until death.

Moreover, almost three-fifths of the patients leaving the custodial hospital exit through the portal of death, whereas in the psychopathic hospital service the patients treated are, on the whole, precisely those who can derive the most benefit from treatment and who are promptly restored to productive life in the community or to conditions which permit them to be cared for outside of a hospital by their families. In both instances the state is saved much money. The difference between a patient vegetating on the wards of a state hospital and being actively at work in the community, socially useful and productive and paying taxes, is so great that it cannot be estimated. Even if the psychopathic hospitals were far less efficient than they are in this respect, they would still represent a marked gain over custodial care. If only one patient in eight is saved from a custodial fate the state loses nothing. Every additional patient saved represents a real monetary gain.

Almost 83 million dollars were spent in 1934 for the patients in state hospitals in the United States. This represents a tremendous burden and anything that can be done to mitigate it should be welcome. Since most of the patients in state hospitals stay year after year and the cost, though minimal, is continuous for long periods of time, it is much better to invest intensively a portion of that cost early in the illness even if the only result is the bringing about of a condition which will enable the family to care for the patient at home.

When we consider that in addition to the intramural treatment of patients we have also the advantages of all of the other functions of the psychopathic hospital (including the extramural treatment of dispensary patients, the benefits from research, the education of medical students, nurses, teachers, and the general public and the inauguration of suitable mental hygiene programs for the prevention of mental disease) at no additional cost, it can be seen that provision of state psychopathic hospitals represents the most economical form of care that the state can provide for the mentally ill.

To be sure, there will always be custodial cases and we will never be free of the need for suitable custodial institutions. It is lamentable that adequate provisions for custodial care are so lacking that the majority of state hospitals are vastly overcrowded and pathetically understaffed. Nevertheless, much more can be accomplished toward improving these conditions by building and organizing adequate acute treatment units than in any other way. It is a fact that in those states where psychopathic hospitals have been built state hospital provision has also improved.

There will undoubtedly be, in the near future, a rapid improvement of the resources of the South for handling these problems. We look forward with the hope and confidence that teaching psychopathic hospitals will be utilized as far as possible. The development of these units is the most urgent need of psychiatry in the South today. Already favorable signs are to be seen in the organization of psychopathic hospital provisions in Louisville and in the great increase in interest and understanding to be noted everywhere.

REFERENCES

1. U. S. Department of Commerce Bulletin, Patients in Hospitals for Mental Diseases, 1934.
2. Colorado State Hospital, Biennial Report of the Superintendent, December 1, 1934, to November 30, 1936.
3. Personal communications.

"DEATH OF THE SENTENCE" IN MEDICINE*

By WILEY D. FORBUS, M.D.
Durham, North Carolina

You who are courteous enough to listen to a chairman's address are entitled to an explanation of what may appear to some of you to be a form of trickery on my part. I refer to the oddity of my title. While I admit that almost any device useful in enticing a group of pathologists to listen to a chairman talk may be legitimate from his own point of view, your chairman pleads innocence of facetiousness and offers you "Death of the Sentence" in Medicine in all seriousness.

There appeared in a recent issue of *The Atlantic Monthly* an article of high literary merit under the caption "Death of the Sentence." The author, Wilson Follett, is no cynic driven to the point of literary murder by jealousy of his renowned contemporaries. The editor apologizes that he was a mere pedagogue at one time, but is no longer guilty of such mental delinquency! Conclusive proof of our critic's right to speak is the fact that he actually lives by the pen. Follett writes of a sentence, the definition of which he quotes in his subtitle as follows: "A sentence is a complete thought expressed in words." He appends the telltale phrase, "Obsolescent definition."

The sentence that Follett defines is dead. He proves it by quoting the works of a list of illustrious modern writers. Listen to Aldous Huxley, for example.

"All the things I thought I should never do again! Such as eating a square meal; but I was doing it after three days."

In a final thrust at Huxley, Mr. Follett writes as follows: of Huxley's well known novel, *Eyeless in Gaza*:

"The final cadence of *Eyeless in Gaza* is a long lyrical paragraph of twenty-two apparent sentences on the beauty of peace. The first of the twenty-two reads: 'Frenzy of evil and separation.' Of the remaining twenty-one, four are sentences by the orthodox canon; seventeen are oppositive phrases or clauses logically and grammatically attached to the four, every one of them innocent of an independent verb. Four sentences divided as twenty-one! An authentic sign of the times. When you have read the paragraph you know that peace means a good deal to Mr. Huxley; also that we Americans have no special preeminence when it comes to driving deceptive wedges between the printed form and the underlying construction of our thoughts."

Perhaps courtesy and respect for the exotic caused our critic to spare Gertrude Stein, but since the matter is not personal to me, I quote here a paragraph from *Your United States*, an article of hers published, ironically, in the same issue of *The Atlantic Monthly*, that carried *Death of the Sentence*. Miss Stein comments upon one of Hollywood's own as follows in a paragraph devoid of punctuation:

"Of course I liked Charlie Chaplin he is a gentle person like any Spanish gypsy bullfighter he is very like my favorite one Gallo who could not kill a bull but he could make him move better than any one else could and he himself not having any grace in person could move one as no one else ever did, and Charlie Chaplin was like Gallo."

It appears that she not only liked Charlie Chaplin, but she and he (perhaps) talked about things—especially herself, as we learn from a

---

*Chairman's Address, Section on Pathology, Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

*From the Department of Pathology, Duke University School of Medicine, Durham, North Carolina.

single "sentence" three-fourths of a column in length composed of 100 words and expressing at least 14 different and distinct thoughts. This sentence is difficult to write correctly and impossible to read aloud. Hence, I quote here only the finale which is the sole orthodox expression in the entire section.

"Anyway we both liked talking, but each one had to stop to be polite and let the other say something."

At long last politeness required a period!

And so it appears that the sentence is dead in high literary circles; the aim of composition has become confusion; the object of writing is to create an impression of a state of mind, conscious or subconscious, or to permit the effervescence of the spiritualistic, or what you will. Language by the will of the first families has been converted into a plaything as the cattle rustling mustang has been transformed into the polo pony.

Medicine from its cradle has been a game of follow the leader. Its devotees are and always have been a body of imitators and borrowers. And so, onward with the literary parade the doctor marches. Listen, if you will, to the following laconic, up-to-the-minute history of a woman who appeared one day in our wards and you will appreciate the fact that the doctor sometimes steps on the heels of his literary leader.

"P. I.—L. M. P. Oct. 7, 1936. P. M. P. One month prior. E. D. C. July 14, 1937. Went to local M.D., Dr. X., Apex, last night in regard to swelling of feet and legs, he advised Duke. No hematuria, pyuria."

Your own records can equal this and for the good of the cause I do not hesitate to parade our family skeleton. Multiply this by 1×10^6 and you have a picture of the every day writings of a profession which travels under the label "learned."

When I raise my voice against this phase of modernity, perhaps you say that my puristic tendencies are incompatible with the demands upon the time and energies of the "busy practitioner" and the "overworked intern." My position may seem highly vulnerable to one who considers the erudite consultant's opinions more important than the form of their expression.

I should like to justify my own errors. Alibis and excuses are comfortable devices even to your critic, but as a clear and accurate means of communication they hardly serve him more effectively than they do others.

I shall not argue, however, since sentence structure in the literary sense is not the burden of my attempt to interest you. My interest, on the contrary, lies in the broader aspects and the implications of the sentence concept. A sentence is a complete thought expressed in words. It has a subject which does something or has something done to it. What it does or what is done to it is not left to the imagination of him who reads it. It is about this complete thought as it relates to medicine that I wish to speak.

Complete thinking in medicine is, I admit, an impossibility since nothing man does is ever finished. Why, then, bother you with it? I do it because our every day performance as teachers, investigators, and administrators convicts us of an astounding unwillingness to take the trouble to think completely, although we may be quite capable of doing so. What evidence is there for such a broad accusation? Let us see sketchily what history we have made.

For 1,626 years and longer nobody seems to have taken the trouble to sit down at his desk and do the simple problem in arithmetic, which William Harvey used to prove beyond any doubt that the blood actually goes around in a circle and does not ebb and flow. Even in those days it seems opinions came easy and pencil and paper cost great effort. The solution of practical problems appears to have been found in philosophical discussions and not infrequently the most acceptable solutions were the products of the most vivid imaginations.

In contrast to this, van Helmont, about 1600, took the trouble to plant a tree in a tub, to watch it grow and to weigh it and its tub when he planted it. When the tree had grown for five seasons he weighed the tree and the tub again. To his astonishment what the tub of soil had lost in weight was less than what the tree had gained in weight. While his trouble did not prove the thesis,

"That all vegetables are produced immediately and materially out of the simple element of water,"

his results spoke through the medium of figures and his quantitative method became a tool for physiological research later to be used by Harvey.

For 1,500 years the lifeless human body was an object to be avoided or to be worshipped. The curious (and the brave) who took the trouble to look at it, did not take the trouble to see it. Little wonder it is that the interventricular septum contained pores permitting passage of

the blood from one to the other side for so long a time! Galen said it was that way and even Vesalius hardly dared deny it, although he had taken the trouble to see.

John Hunter was virtually thrown out of his hospital appointment because he dared to attempt a coordination of growing physiology and the practice of clinical medicine, a reform for which medicine had cried out for a hundred and fifty years. His struggle to introduce new methods of instruction for students designed to acquaint them with the practical value of the basic sciences nearly caused a professional riot in the London hospitals. The unsympathetic attitude of Hunter's clinical colleagues finally drove him to professional seclusion and near isolation. But it will be recalled that the most distinguished clinician in London at the time was the pupil of John Hunter and not the pupil of his critics. It will also be remembered that it was Matthew Baillie, that same most distinguished London physician, who made the first significant contribution to pathological anatomy in English and whose work represents the third step in the development of our relatively young science of pathology.

The contempt which doctors exhibited in the past toward those colleagues who attempted to study disease from other points of view than clinical observation and philosophical discussion constitutes one of the real wonders of our professional history. Let me quote you, for example, what one Thomas E. Mitchell of Frankfort, Pennsylvania, wrote about postmortem investigations as late as 1827.

"If the symptoms of a case, its relation to some prevailing disease, or its existence in a family strongly characterized by the hereditary predisposition, be not competent to determine its true character, I defy the knife of the anatomist to settle the difficulty, however dexterously it may be managed, and however great a display of morbid structure may be thus developed."

While Mitchell was defending Sydenham's therapeutics of trial and error, and therapeutics was about all there was to medicine in this country before 1800, the Parisians were hard at work with the very technic that he was condemning and defying. It is hardly necessary for me to review what Bichat, Broussais, Laennec, Louis, Pinel, Corvissart and Andral did with autopsies. (I use the term "autopsy" purposefully, not "necropsy" for our forbears did actually "see with their own eyes" and did not merely "view a dead body.")

Further evidence of tardiness in the recognition of non-clinical methods of investigation of disease may be found in the experiences of our early American pathologists. William Horner, for example, went to considerable trouble with his first American textbook of pathology in 1829 to transfer a little of the French ferment to the west Atlantic, but died a solemn, sad, disappointed and apparently completely unsuccessful would-be reformer. The following excerpt from the preface of the third edition of *Elements of Pathological Anatomy*, by Samuel D. Gross of Philadelphia, in 1857, a half century after Bichat and his "membranes" and Broussais and his "chronic phlegmasias" condemns the contemporary American profession as emphatically as Mitchell defied the pathologists.

"In the forty-five medical colleges which, at this moment, exist in the United States, there is not, with perhaps a few exceptions, a chair of pathological anatomy; thus clearly showing that the teachers connected with these institutions have either no very exalted opinion of the value of this science, or that they are afraid of innovation. While almost everything else is taught, from a sesamoid bone and a globule of blood the 1/3000th part of an inch in diameter up to the skeleton of the mastodon, hardly a solitary voice is heard, during the whole session of our colleges, in favor of pathological anatomy. This is a strange and culpable oversight, and one which should be speedily corrected. We may cram our pupils with healthy anatomy, physiology, materia medica, chemistry, and in short, everything else embraced in our curriculum of study, and yet, if we neglect to instruct them in this branch of knowledge, it will be in vain for us to attempt to make good diagnosticians and practitioners of them. Let us, then, while we hope for better things, endeavor soon to extricate ourselves, as the representatives of a great and noble profession, from the false position in which we now stand in relation to this all-important science, and its application to the nature, discrimination, and treatment of disease."

If the past seems to make us uncomfortable, perhaps there may be solace in the present, for according to some, medicine has reached its majority. I wonder how much complacency accompanies our maturity. A brief inquiry into the matter may serve us usefully.

How complete is our thinking about disease as we meet it daily in our autopsy rooms and in our clinics? How much trouble do we take to pursue to the limit our opportunities for the investigation of spontaneous disease? Our colleagues, the clinicians, say,

"We are limited by the very nature of the personal aspects of the problem of disease and can go no further than our clinical technic permits. Ours is a practical problem hedged about by all sorts of personal difficulties

impossible to overcome. We can't get autopsy permits. Our patients won't stand for it."

Everybody knows that the difficulty is the added effort required, not the patient's sensibilities. And what do our colleagues the pathologists say? They speak in this lordly manner,

"Autopsies are routine affairs for the instruction of the intern. Why waste my time on common routine? I am needed with my animals and my experiments (or with my golf!) Pathological anatomy is passé. Nothing more can be learned from it. It is 'dead-house' medicine."

Such attitudes toward our richest source of materials for complete thinking, I am afraid, have played their roles in filling our journals with much worthless chatter, expensive to print and profitless to read.

This is an age replete with research activity, and in its way a credit to us. It is the ideal and aim of every progressive medical organization whether it be private clinic or highly endowed research institute. But men do research, and research has become a business and a career. It must justify itself. It must produce results. To deny that the element of personal or group ambition and competition plays a dominant role in our research activities is simply not to know what is going on. Numbers of papers and priorities besmudge our scientific reputations. Personal ambitions get the best of slow, sound critical judgment and the profession is overwhelmed by a mass of data, often meaningless because of its incompleteness and its circumscription. Promises of the contributors to give the implied meaning to such data in future publications afford no comfort since such promises are rarely kept. We all know this for "journal of priority" is an expression very familiar to everyone and its connotation does us no credit.

I have always been impresssed by the heavy load of responsibility which rests upon the shoulders of pathology for the cultivation of complete thinking about medical problems, and it is this very attribute which makes me believe in it as I do. The physiologist lived and worked many years with hardly more than a casual thought of the broader aspects of his science or of the application of his discoveries to the healing art. The clinician likewise lived and worked for centuries, and some do still, without a thought beyond empirical therapeutics and philosophy. It has always been as impossible for the pathologist to isolate himself and his work as it is for the sun to fail to rise tomorrow morning. And for what reason is this? It is simply that pathology is not a science unto itself. It is an integration of all the medical sciences. Some of our very own would have us think differently perhaps. They tell us, for example, that there is surgical pathology, neuropathology, general pathology and special pathology, tissue pathology and clinical pathology; and it embarrasses me to say that there are some whose letterheads carry the designation, "pathologist," who are quick to explain that they are engaged in the study of living pathology, not dead-house pathology. Complete thinking knows no such departmental dissection.

Pathologists in the role of both teachers and practitioners sometimes complain of an unfavorable attitude which many clinicians exhibit toward their science and of the minor role it seems to play in the work and life of the profession. There is much that one might say about this, but I wish to point out only one highly significant fact. It is this. Our clinical colleagues are the products of our own teaching. It is we who gave them their fundamental concepts of the nature of disease or who failed to do so. Our chickens have the habit of coming home to roost! A microscope and a box of slides faded from years of use is no adequate diet for young, enthusiastic, impressionable students literally crying out to be acquainted with the fascinations of coordinated and complete thinking about the problems furnished by the sick man. I am sometimes astounded by the attitude toward students exhibited by some of us who regard ourselves as broad complete thinkers. Complete thinking seems essential for us, but the student must have a limited diet for fear he may become choked on our pearls! Our students do not tell us what they think of us until they become our clinical colleagues!

Our profession has many attributes which justify its pride in itself. Its family skeleton is its outlandish egocentric attitude of mind. I think I could place before you a reasonably successful defense of that attitude. I prefer, however, to let someone else do that and to use this opportunity to point out what I think is fundamentally its origin. It is easy to be the wise man where ignorance dominates. Health and disease are still mysteries to the lay public and unknowingly the public sets the stage for the build-up of the doctor's ego. The natural confidential relationship between doctor and patient accomplishes it. The doctor is the wise man among the ig-

norant. Since he must be man, as well as physician, only the habit of and the capacity for complete thinking can save the physician from his ego. Every doctor is a great man in his own community and his greatness increases with his age, not his intelligence. We acknowledge the value of practical experience in medicine. The most impressive statement the physician can make to establish his professional position in the eyes of his community is,

"I have practiced medicine for forty years."

Indeed, that is enough to make a great man of anyone who has never had his practice questioned, and especially one who has never questioned his own practice.

We are all familiar with the predicament of the doctor in court because we have been there, and we know that no medico-legal experience ever leaves our profession unscarred. My own embarrassing experiences have taught me that the honest disagreements of doctors in the face of the law come, almost without exception, from incompleteness in thinking. The problem either has not been thought through or the trouble has not been taken to assemble the data necessary for thinking it through. Increasing demand upon our profession for aid in matters which affect the economic status of our people is little by little forcing us from behind our screens of mystery and demanding that we meet the problems of economic life as men of other professions do. We are rapidly coming to the point where we must think through our problems or else be publicly discredited. Superficiality will no longer satisfy a public which daily increases its knowledge and its critique.

To return to my theme, I say, we must make a sentence of medical thinking. I do not feel that the "sentence" is dead in medicine. I am certain, however, its life is not an automatic affair. Its death can be prevented only by our taking the trouble to do it. As pathologists we must be willing to assume the burden of leadership in the cultivation of this attitude. It is a natural responsibility for us and one not without its rich rewards.

I am conscious of the fact that during this brief discussion my emphasis has been placed upon the unflattering aspects of our profession. That has been my intention and I offer no apologies for this attitude. I have simply chosen on this occasion to make use of the opportunity which custom provides to exercise the right, to enjoy the prerogative, and to discharge the plain duty of every pathologist as I see it. That duty is to be critical.

SYMPOSIUM ON MALARIA—Part 1‡

THE OCCURRENCE OF *ANOPHELES WALKERI* THEOBALD IN GEORGIA*

By R. EDWARD BELLAMY, M.S.
and
JUSTIN ANDREWS, Sc.D.
Atlanta, Georgia

More than eighty larval *Anopheles walkeri* were identified in collections made between September 15 and November 11, 1937, from 7 different permanent or semi-permanent shallow ponds in southeastern Sumter County, Georgia. All the ponds supported heavy growths of emergent vegetation supplemented in several instances by submerged and floating vegetation and considerable debris. Water from 4 ponds showed a range of pH from 5.6 to 6.8 as determined by a Hellige comparator; two others, tested with nitrazine paper, showed pH values of 5.5 and 7.0, respectively. Larvae of *A. crucians* were found in each collection with *A. walkeri; A. quadrimaculatus* was found in association twice, and *A. punctipennis* once. All larval *A. walkeri* were of the southern race distinguished by Bradley,† though hair 0 on abdominal segments 2 to 6 inclusive was, almost without exception, 4-branched.

Twenty adult female *A. walkeri* were taken with collecting tubes while biting between 9:30 and 11:30 p. m. October 5, within 50 feet of a productive breeding place. They bit man readily, but were easily flushed with diffuse flashlight. None of these were dissected. A single *A. crucians* was the only other anopheline taken during the collecting. All of the wild-caught females plus five raised from larvae resembled the Florida specimens, having quite distinct bands of white scales on the palpi. Two reared males appeared to be similar to *A. quadrimaculatus,* though they were perhaps somewhat darker. Mounts of terminalia were not prepared.

A. walkeri is of interest to the malariologist not only for its potential ability to transmit malaria, but because of the likelihood of its confusion with other anophelines. The superficial resemblance of adult *A. walkeri* to *A. quadrimaculatus,* and the similarity of larvae of *A. walkeri* to those of *A. quadrimaculatus* and *A. punctipennis* might lead to error in hasty routine identification.

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30–December 1-2-3, 1937.

*Contribution No. 1 from the Division of Malaria Investigations, Georgia State Department of Public Health, Atlanta, Georgia.

†Bradley, G. H.: On the Occurrence of *Anopheles walkeri* Theobald in Florida. Sou. Med. Jour., **29**:857-859, 1936.

‡The Symposium on Malaria, papers from the National Malaria Committee (Conference on Malaria), meeting conjointly with the Southern Medical Association at New Orleans, Louisiana, November 30–December 1-2-3, 1937, which are to be published in the SOUTHERN MEDICAL JOURNAL, will appear in two parts: Part 1 in this issue, and Part 2 in August.

HISTORICAL DEVELOPMENTS AND PROGRESS IN OUR KNOWLEDGE OF MALARIA CONTROL*

By W. V. KING, PH.D.
Orlando, Florida

The suggestion was made by Dr. Frank K. Boland, President of the Southern Medical Association, that some historical aspect of medical progress be presented on the sectional programs. In accordance with this suggestion, which I was glad to accept, an outline has been prepared of the topics indicated in the present title, with particular reference to entomological phases of the subject.

Progress in the warfare against malaria has been made possible by an accumulation of knowledge and experience over a period of many years. The important discoveries prior to 1900 have been recorded many times, but the list is a short as well as a notable one, and we should, I think, take this opportunity to recall briefly the earlier outstanding events that have contributed either directly or indirectly to our present knowledge. These begin logically with the introduction of cinchona bark into Europe, which occurred about the year 1640. The bark was said to have been taken to Europe first by the Countess of Chinchon, who had been cured of an attack of malaria by its use in Peru a few years previously. This occasion has been referred to by Boyd as "probably the most important event in malariology for the space of two thousand years." The extraction of quinine from the natural bark took place nearly two hundred years later, in 1820, and is credited to the French chemists, Pelletier and Caventou. In addition to its inestimable value in the treatment and cure of the disease, experimental observations made by Binz in 1869 on the toxic effect of quinine on ameba was believed by Celli to have suggested the theory that the cause of malaria was a protozoan. The more recent use of quinine as a weapon in malaria prevention will be referred to later.

In 1878, Manson made his famous observations in China on the development of *Filaria* in mosquitoes.

*Chairman's Address, National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30–December 1-2-3, 1937.

*From the Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, Orlando, Florida.

While it was not known for many years that the organism was also transmitted by the bite of the insect, the belief being that human infection was acquired from the water in which infected mosquitoes had died, the discovery was of special significance in drawing attention to mosquitoes as possible hosts of other parasitic organisms.

Laveran's discovery of malaria plasmodia in the blood stream occurred in 1880. This was followed by intensive studies of the parasites, which soon resulted in the differentiation of the three common species, in descriptions of the asexual cycle of development, and in a much sounder knowledge of the disease itself. Castellani and Chalmers refer to Laveran's work as "the discovery which has had the greatest influence on tropical medicine."

Gerhardt, in 1882, found that malaria could be produced in a healthy person by the inoculation of blood from an infected person. Inoculations had previously been tried, but the experiments of Gerhardt were thought by Ross to have been the first successful ones, and were apparently conducted without knowledge of Laveran's discovery.

In 1893, Smith and Kilborne (in the United States) proved that *Babesia bigeminum*, a protozoan parasite of cattle, was transmitted by the cattle tick, *Boophilus annulatus*. This is accepted as the first demonstration of the actual transmission of a disease organism by an arthropod definitive host. In the following year (1894) Bruce proved experimentally that a trypanosome (*Trypanosoma brucei*) was conveyed by a species of *Glossina*, although its transmission was believed to be by mechanical means alone and the development of the parasite in the insect was not discovered until some years later.

In 1897, Ronald Ross made his memorable report from India "On Some Peculiar Pigmented Cells Found in Two Mosquitoes Fed on Malarial Blood." This appeared in the *British Medical Journal* of December 18, forty years ago. The pigmented cells had been observed on the stomachs of two specimens that had been allowed to feed on a person whose blood contained malaria crescents. The bodies as described are now easily recognized as an early stage of oocyst formation, and the description of the mosquitoes (wings with four dark spots on the anterior vein) shows that they were a species of *Anopheles*. Similar infections in a "dapple-winged" mosquito and in a "grey or barred-back" mosquito were described by Ross in a second report.

Lacking suitable opportunities for continuing the work with human parasites, experiments were undertaken with bird malaria, and in 1898 Ross described the various stages of oocyst development in "grey mosquitoes." Later in the same year, he observed the formation of sporozoites and found that they invaded the salivary glands. He also obtained experimental infection of healthy birds by the bites of infected mosquitoes.

Upon the appearance of Ross' first reports, similar experiments were undertaken by the Italian workers Grassi, Bastianelli and Bignami, and several papers on the subject were published by them toward the end of 1898. They followed the entire cycle of development of the human parasite in the mosquito, which proved to be almost identical with the cycle of the bird parasite, and determined that the species of mosquito concerned was of the genus *Anopheles* ("*A. claviger*," or *maculipennis* as now known). In one of the papers, the first case of mosquito-transmitted infection was reported in a patient who had been exposed to the bites of wild-caught mosquitoes. The development of bird malaria in mosquitoes was also confirmed during 1898 by Koch (in Italy) and by Daniels (in India).

While the discoveries listed above are the outstanding ones and form the scientific basis upon which our knowledge of malaria rests, the accumulation of information was a gradual process and many workers contributed ideas and observations. For example, the mosquito theory of malaria and yellow fever transmission was advanced by J. C. Nott, of New Orleans, in 1838, and by L. D. Beauperthuy in Venezuela in 1853. In 1883, Dr. A. F. A. King, of Washington, published an important paper in which he presented a forceful argument for the mosquito theory based on observed correlations in the occurrence of these insects and malaria. Between this date and 1897 the idea was referred to by a number of European workers and Ross' experiments were actually begun in 1895. In the meantime, attempts to obtain inoculation of humans by mosquitoes are said to have been made in Italy by Bignami and Dionisi, while Grassi had made an epidemiological study to determine what kinds of mosquitoes were constantly associated with malarious areas. McCallum's observations in 1896 (published in 1897) on the flagellate stage of malaria parasites proved that sexual forms were produced and that fertilization took place after the blood was withdrawn from the warm-blooded host. The development of *Filaria* in mosquitoes, the transmission of cattle fever by ticks, of trypanosomes by tsetse flies, and, even prior to these, the knowledge that insects served as intermediate hosts of certain worms and that anthrax might be transmitted by insects, were undoubtedly of great importance in focusing attention upon insects as possible vectors of disease.

Final proof of the mosquito role was quickly forthcoming. Following Ross' inoculation experiments with bird malaria, cases in human beings were produced in Italy by the bites of infected *Anopheles* and two cases were produced in England (one of them the son of Sir Patrick Manson) by the bites of *Anopheles maculipennis* that had previously been fed in Italy on persons with benign tertian, or *vivax*, infections. Demonstrations that persons could live in malarious areas without becoming infected, provided they were protected from mosquitoes, were made in Italy during 1900 by Grassi and by Sambon and Low.

As a result of these discoveries it was believed that the key to malaria had been found, and immediate in-

quiries were started into the means by which the knowledge could be put to practical use in reducing a disease of such tremendous importance. The need for information on the habits of mosquitoes was recognized and the foundations of our present day literature began to accumulate in the scientific and medical press. With the further discovery of mosquito transmission of yellow fever in 1900 the study of mosquitoes was greatly accelerated at the beginning of this century, until today a literature of enormous proportions has developed.

The immediate need for taxonomic, or systematic, work on the group was also recognized because almost the first experiments with malaria parasites had shown an evident difference of different kinds of mosquitoes in susceptibility to infection. One of the earliest systematic works on mosquitoes was published by Howard in 1900 as a bulletin of the Bureau of Entomology, United States Department of Agriculture. An earlier bulletin, containing a general account of mosquito habits and remedies, had been published in 1896, while another article by Howard in 1900 gave the life history of *Anopheles quadrimaculatus*. In England during the same year the first edition of Giles' work on mosquitoes appeared, and in 1901 the first two volumes of Theobald's monograph on the mosquitoes of the world. A small volume giving a semipopular account of mosquitoes was also published in the United States that year by Howard. Studies of the Culicidae, and particularly of *Anopheles*, have been continued increasingly to the present day. The larger publications that contain important contributions to our knowledge of anopheline classification include the works of Blanchard (1905), Howard, Dyar and Knab (1912-1917), Dyar (1928), and Christophers (1933). An extremely important catalogue of the Culicidae of the world, by the British authority F. W. Edwards, appeared in 1932. This gave a complete list of described species, together with their synonyms and a sound classification. In the subfamily Culicinae, Edwards recognized 30 genera and some 1,400 species, while the tribe Anophelini contained 3 genera, 166 species, and about 50 varieties or subspecies. A considerable number of new species have since been described.

As previously mentioned, the possibilities of malaria control opened up by the discovery of mosquito transmission were immediately recognized. Ross himself published the first of various articles on this subject in 1899 and in July of that year, with H. E. Annett and E. E. Austin, left for West Africa to look into the matter of malaria control at Freetown, Sierra Leone. During a seven weeks' stay at this place, two species of *Anopheles* (*costalis* and *funestus*) were incriminated as vectors, and observations were made on their habits. The research work here was continued by Stephens and Christophers, who later (1901) were sent to India for similar investigations. Ross, with a small fund raised privately in England, returned to Sierra Leone in 1901 and undertook practical mosquito-control work.

In 1900, experiments were conducted in Italy by Fermi and Tonsini, Grassi, and Celli to determine the effect of protecting people from mosquito bites. The principal measures employed were the screening of the houses and use of bed nets, although the oiling of pools and the fumigation of the houses with chrysanthemum powder were also employed in one of the experiments. Berkeley in the United States reported the control of a small outbreak of malaria in a suburban New York town in 1900 by a combination of measures that included the destruction of the adult *Anopheles* in the houses and filling or draining of the breeding places. An experiment in protecting troops from the bites of mosquitoes was carried out in Formosa in 1901. In each of these experiments a marked reduction of infection among the protected persons was reported.

To Koch is attributed the original suggestion that the elimination of mosquito transmission could be accomplished by treating all infected persons with quinine. He undertook a demonstration of this method in 1901 in Stephansort, New Guinea, and the results were reported as having been very successful. A continuation of the work there on a larger scale, however, was said to have been less satisfactory and indicated that the method had its practical limitations.

Malaria-control campaigns based mainly on antilarval methods were undertaken also at the turn of the century in widely separated areas. The results of these were of the greatest importance in establishing this principle as a primary line of attack. Two of the earliest of the campaigns were those undertaken under the directions of Gorgas at Havana and of Watson at Klang and Port Swettenham in the Federated Malay States. The work in Havana was started early in 1901 and was directed primarily against yellow fever, which was completely eliminated. By means of minor drainage operations in the suburbs, malaria also was greatly reduced. At Klang and Port Swettenham remarkable results in the control of severe epidemics were obtained almost immediately by draining or filling of mosquito breeding places, supplemented with jungle clearing. The antilarval work was later extended to rural areas in Malaya.

Other early anti-anopheline campaigns were those in Egypt (initiated by Ross) and Algeria in 1902, in Khartoum in 1903, and in the Transvaal in 1904. In 1904 also was begun the work of Gorgas, LePrince and others in Panama, with which we are all familiar.

In the United States, antimosquito work on a community basis began as early as 1900, but most of this was directed toward the elimination of mosquito annoyance. A few isolated instances in which special attention was given to the elimination of *Anopheles* breeding places have been given by Howard in a review of the early mosquito work in this country. Some of the localities mentioned as having carried out such operations were the suburban New York town (previously mentioned) in 1900, Staten Island, New York, in 1901, Brookline and Worcester, Massachusetts, in 1901-1902.

Talladega, Alabama, in 1902, and Long Island, New York, in 1902-1903. Efforts to control the disease on a large scale, however, were not undertaken as a part of the general health programs of the Southern states until about 1913, when malaria surveys and control demonstrations were begun by Carter, Von Ezdorf and other members of the United States Public Health Service. Cooperative demonstrations were also undertaken soon afterward by the International Health Board of the Rockefeller Foundation. Three years later, in 1916, the National Malaria Committee, our first association of malaria workers, was organized.

From the historical standpoint a paper published by Nuttall in 1899 is of considerable interest, since it contains a critical and historical review of the knowledge of the role of insects and other arthropods as carriers of disease up to the time of the final proof of mosquito transmission of malaria. While its value lies chiefly in its record of the earlier experimental work and theories, it is also of interest to note in this and other writings of the time the number of things referred to in connection with mosquito or malaria control which we still regard as standard practices. For instance, we note that drainage and the use of mosquito nets had long been recognized as of benefit to residents in malarious areas, even though the reason therefor was wrongly interpreted. To reduce mosquito annoyance, the drainage of breeding places, the use of oil and predaceous fish for destroying the larvae, the screening of houses, and the use of pyrethrum as a fumigant were all more or less well known, so these methods were immediately available for the new anti-anopheline work. In attempting to analyze the progress in our practical knowledge of malaria, it may be instructive to review briefly the present status of these measures.

Drainage.—Ross states that "for several centuries the Italians, and other nations, have known how to control malaria by drainage and allied measures." The methods employed for sanitary and agricultural drainage had been developed from ancient times, and Celli in 1900 gave a good review of methods that could be adapted to the elimination of *Anopheles* breeding places. He discussed the regulation of flooded rivers, lakes, marshes, and ground waters, and speaks of drainage wells, the interception of seepage outcrops, the paving of open ditches, and especially of the value of subsurface drains. His reference to the paving of open drains is of interest because, until recently, this method has been neglected to a large extent in the United States. Watson gives a picture of a concrete invert that was installed in Klang in 1902, and the method was used extensively in the Canal Zone. A recent development there has been the manufacture of concrete inverts in short sections, which are economical in cost and readily installed.

Filling, draining, or sanitation of mosquito breeding places are still employed as the more permanent measures in *Anopheles* control. The principal progress that has been made has been due to the improvement and cheapening of methods, their adaptation to meet specific or unusual problems, and their better application as a result of increased knowledge of anopheline habits and species control.

Larvicides.—Nuttall states that the first experimental work with kerosene oil as a mosquito larvicide was done by Aaron in 1890 and by Howard in 1892, although its use for this purpose was said to have been known for a good many years previously. Since the time of Howard's experiments we have learned a good deal about the action of oils and methods of application, and oil remains today one of the standard larvicides. Recently, an emulsified larvicide consisting of kerosene oil, pyrethrum extract, and soap has been developed in New Jersey and has proven to be effective and economical against salt-marsh and domestic species, although it has not been used to any extent in anopheline work. Another larvicide, consisting of phenol and resin, was developed during the work in the Canal Zone and was reported as very effective under the conditions encountered there. It has not, however, been used extensively elsewhere.

The discovery of Barber and Hayne, in 1921, that Paris green was highly effective in destroying anopheline larvae when applied as a dust to the breeding places is one of the important developments in the larvicidal field. This discovery was preceded by the experiments of Thibault in the United States, using vegetable powders, and of Roubaud in France, using paraformaldehyde, which showed that anopheline larvae could be killed by the application of dry larvicides. Paris green is effective in very small quantities and has proven to be of special value for treating extensive breeding areas and for use against breeders in streams. Experiments by King and Bradley in 1922 showed that Paris green dust could be applied effectively to large breeding areas by means of airplanes, and this method has been employed in practical control work in a number of places in the United States and Russia. An extensive trial of this method is now being made by the Health and Sanitation Section of the Tennessee Valley Authority for the control of anopheline breeding on the large impounded areas in the Tennessee River.

Protection against Adult Anopheles.—Screening of houses to exclude mosquitoes and house flies is believed to have been developed chiefly in the United States, a good many years before it was known that mosquitoes were carriers of disease. Following Ross' discoveries, some of the first proofs of the mosquito "theory" were those in which it was demonstrated that persons would remain healthy in a malarious area if protected from mosquito bites. While this method is still employed extensively in the United States, in many places forming the principal defense against infection, it is said to have been neglected to a surprising extent in most of Europe and in the tropics generally. Bed nets have been, and still are, used extensively for the same purpose.

Pyrethrum powders have long been employed as a

fumigant for incapacitating and repelling mosquitoes and are still the most effective of the substances available for use in occupied rooms. An important development of recent years is the manufacture of liquid sprays containing pyrethrins, the toxic substances contained in pyrethrum flowers. In addition to the extensive use made of such sprays for destroying mosquitoes and other insects in dwellings, they are now employed for spraying in airplanes as the principal means of preventing the introduction of dangerous mosquitoes from one country to another.

An interesting large scale experiment with pyrethrum spray as a practical malaria-control measure has been reported by Thornton in the Union of South Africa. In the difficult native areas where general control of anopheline larvae was impossible, supervised spraying, with power sprayers, was carried out in some 18,000 native huts during 1932 and extended to about 45,000 in 1933. This was said to have given a marked reduction in the percentage of infected mosquitoes and in the death rates and percentage of enlarged spleens in the native population.

Quininization.—As previously mentioned, Koch is credited with the original suggestion for employing quinine as a public health measure. He believed that mosquito transmission could be eliminated by the thorough treatment of all infected persons in a community and his early experiments in New Guinea appeared to be highly successful. Since that time the method has been tried in many parts of the world, with a great deal of variation in results. In the United States, an important large scale experiment was carried out in Mississippi by Bass, beginning in 1916. The subject of malaria control by drug treatment was discussed by Williams before this Association two years ago and he concluded that the method was not now a hopeful one, being difficult to apply successfully or economically. This appears to be the majority opinion among malariologists at the present time. Nevertheless, significant progress has been made in the preparation of synthetic substitutes for quinine and it is possible that further research may produce a method of treatment that more nearly meets the problem.

Control by Natural Agencies.—Mosquitoes have a great many natural enemies and the combined effect of these upon the mosquito population must be very appreciable. While much thought has been given to means for increasing their effectiveness, the only predators that have been employed with much success up to the present time are the small larvicidal fish, of which our native *Gambusia* is by far the best known. This minnow is abundant and widely distributed throughout the Southern states and is unquestionably of much benefit in destroying mosquito larvae in places where the water surface is comparatively free of protection. Unfortunately, our species of *Anopheles* select waters in which growths of aquatic vegetation or accumulations of floating debris offer effective hiding places. Under such conditions the fish are unable to attain a high degree of efficiency and their limitations in this respect have caused a noticeable lessening of the enthusiasm toward fish control formerly shown by malaria workers in this country. Nevertheless, we feel certain that the situation would be much worse here if this active predator were removed from all the Southern waters.

Gambusia has been introduced from the United States into Europe and various other malarious countries. The reports indicate that the results have been decidedly worth while in many instances, and it is possible that in new territory or with different *Anopheles* this species may become more effective than in its native habitat.

Much attention has been given to other phases of natural control, particularly to that expressed by the term "biological control." In the investigational field, studies have been made on larval food and nutrition, on the chemical and physical composition of the breeding waters, deterrent and larvicidal plants, ecological associations, parasitic micro-organisms, and other subjects. Little of this information has as yet found practical application, but the research is of the greatest importance and is adding daily to our knowledge of the factors that determine mosquito existence. In a rather rough way, successful attempts have been made here and there to adapt the principles of biological control to field conditions, and we know that protective aquatic growths can be permanently controlled at times by altering the water level, that increasing or decreasing the amount of shade has been effective with certain species, as have also changes in the salt content of the water. Other examples might be cited in which the principles have been carried somewhat further, but the field of biological control as a whole, I think, has scarcely been touched as yet. In the opinion of many it offers the greatest opportunity of any for possible advancement.

Mosquito Studies.—Probably the greatest progress in our knowledge of malaria control has to do with the information accumulated on the bionomics and classification of *Anopheles* and the relation of different species to malaria transmission. The systematic work alone, which forms the foundation of our knowledge, has required the painstaking efforts of an untold number of workers. During the earlier days, only those species were recognized in which the differences were plainly visible. As the work progressed, more and more species were distinguished and, at the present time, we know that the very closest study of anatomical details in all stages of development, combined with biological information, is required to separate some of the important forms. It is probable that more than 250 species and subspecies of *Anopheles* are now known. One of the reasons why such close taxonomic work is important is the fact that two or more forms which are almost indistinguishable in appearance may vary so widely in habits that one is a dangerous vector while the others may be of little or no concern.

Along with the taxonomic work on *Anopheles*, extensive investigations have been made of their relation to

malaria transmission. While different species show considerable variation in susceptibility to infection, no species of *Anopheles*, I believe, has proved to be entirely refractive to infection when adequately tested. A considerable number of species have also been found infected under natural conditions. We now know, however, that the ability of an anopheline to become an effective vector depends primarily upon its blood-feeding and house-frequenting habits, and a great deal of information has been accumulated on these subjects. One of the important technics developed for determining the blood-feeding habits is the precipitin method for identifying the blood meal, which was first used on a large scale in connection with our work in Louisiana in 1922. An outstanding result of all this work is the knowledge that only a very few, probably less than a score, of the many species throughout the world are of primary importance as vectors. In any one locality, it has been the usual experience to find that a single species stands either alone or else very much above the others in importance. From the practical standpoint this has led to what is now well known as "species control," or the limitation of control measures to a particular species, which has come to be regarded as one of the basic principles of economic antimosquito work.

This principle has been thoroughly reimpressed upon our minds by recent developments in Europe, where it has been found that *Anopheles maculipennis*, long known as their chief vector, actually consists of at least six varieties or biological races. Three of these appear to be highly dangerous wherever found, while the other three are much more "zoophilic" and seldom of importance. Most of these races are indistinguishable in the adult or larval stages and are recognized chiefly by the egg patterns, which were first described by Falleroni in 1925 and 1926. This is rather an extreme case of species differentiation, but the taxonomic value of the patterns has apparently been confirmed by correlated differences in habits of the larvae and adults, and by cross-breeding experiments. Although it was some years before the significance of Falleroni's observations was generally recognized by the epidemiologists, the discoveries have now helped to elucidate some of the most perplexing problems of those countries, particularly that of "anophelism without malaria."

It is not within the scope of the present paper to attempt an analysis of the progress made in the reduction of malaria by preventive measures. A world-wide picture of present conditions as compared with 20 or 30 years ago would be highly instructive but probably impossible to obtain with any degree of accuracy. We are all familiar with the fact that the disease has disappeared from large areas in the North Temperate Zone and has also shown marked regression in Southern parts of the United States and Europe. Much of this decrease occurred before any general efforts at control had been made and it is customary to attribute this disappearance to the effect of agricultural development and other economic factors.

In the Southern part of the United States the question has frequently been raised as to what progress the control efforts have shown. During recent years there have been periods of declining malaria rates which have given encouragement to the belief that the work was beginning to show definite results. Unfortunately these have been followed by correspondingly large increases, and we now recognize the occurrence of cyclic waves of malaria prevalence, at least two of which have occurred in the past fifteen years. In a paper presented before this Association two years ago, giving statistics on malaria in the United States, the authors found that there was little change in mortality rates in 1934 from those in 1920, which covers most of the period during which malaria control has been included in the public health program. A considerable number of campaigns have been conducted in urban communities and a general improvement in towns and cities has been noted. Malaria in the Southern states, however, is essentially a rural disease, so the general infection rates could not have been greatly influenced by these results. In the rural areas there have been a few excellent demonstrations of wholesale screening of dwellings, while education in the principles of individual protection and better treatment has advanced. There are not many areas, though, where permanent antilarval measures can be carried out effectively by present methods at a feasible per capita cost, and one of our leading malariologists has stated recently that new information is needed before the malaria problem can be solved in rural communities. This implies that further research and a revision of methods or procedure are required.

One of the interesting developments of this past year has been the organization of "malaria control units" as administrative divisions in the Southern state boards of health. The personnel of each unit, as proposed by the Public Health Service, is to consist of a medical malariologist, an entomologist, an engineer, and one or more laboratory technicians. This development contains two significant features, I think, one of which is the increased attention to be given the subject by the formation of specially trained groups, and the other, the recognition of a need for entomological personnel in the state malaria organizations. As an entomologist, I am particularly impressed with the latter feature because the tendency heretofore (ever since the time of Ross, in fact) has been to assume that a working knowledge of the insect could be easily acquired and that its control, therefore, was largely a matter of applied mechanics or administration. Experience has taught us that the problem of malaria is very much more complicated than this and requires the attention of well-trained specialists rather than a general practitioner. The fact has frequently been lost sight of that the control of *Anopheles*, as of other insects, is primarily a biological problem.

A. ALBIMANUS BREEDING IN RELATION TO DEGREE OF SHADE IN BREEDING PLACES*

By HENRY P. CARR, M.D.†
Havana, Cuba

Although it is generally understood that mosquito breeding places which have exposure to sunlight are more favorable for *Anopheles albimanus* than are shaded ones, the literature reveals few published observations regarding this. At the suggestion of Dr. Mark F. Boyd, we have studied the relationship of *A. albimanus* breeding to sunlight and have made certain observations regarding this matter, which it is thought may be of sufficient interest to justify reporting here.

We have found near Havana a number of situations in nature, of which the following is typical. A small stream, about one and one-half meters wide at the water surface and with very slight current, is fully exposed to the sun except for a stretch of approximately thirty meters where there are about forty fairly sized shade trees disposed in a double row on each side of the stream. These trees are apparently the remnant of a small thicket. This portion of the stream is well shaded so that, although direct rays of the sun do strike the water surface, any given portion will get direct sunlight only for a very short while each day. In the shaded portion of the stream no algae and almost no vertical vegetation is present. No mosquito larvae were found at several observations. In the unshaded portion of the stream, both above and below the thicket, there is a very abundant growth of a green alga (*Spyrogyra nitida*). Upon these algal mats there is abundant breeding of *A. albimanus,* while *Gambusia* are present in both the shaded and unshaded portions of the stream.

The following experiment was carried out. We constructed a palm leaf thatch roof over a section of a small stream. The surface of the water in this stream is about three meters wide. The thatch roof is at a height of about five feet from the surface of the water and covers the stream for a distance of about fifteen meters. The shade cast is almost complete, so that practically no direct sunlight reaches the stream. It is about the degree of shade which would be present underneath a small clump of several fairly good sized shade trees set close together. Readings with a Weston exposuremeter, held at a distance of one meter from the water surface and directed towards the water so as to measure the reflected light, show typical readings, as for example, the following: on March 23 at 11:00 a. m. of a cloudless day, the reading in the shade was 10 and a similar reading made in the full sunlight and measuring the amount of light reflected from a grass plot read 80. When the roof was constructed there was an exceedingly heavy growth of spyrogyra throughout the whole length of the stream, covering about one-third of the width of the stream at each side, the central third remaining clear due to the current. Prolific albimanus breeding was present in this floating algae. *Gambusia* were present in large numbers. After the roof had been in place for one month the spyrogyra had entirely disappeared from the shaded portion, although it remained abundant both above and below this area. With the disappearance of the spyrogyra no mosquito larvae could be found, although they remained abundant in the unshaded portions of the stream. The slight difference in temperature of the water in the unshaded and shaded portions of the stream does not affect the mosquito breeding.

In order to test the effect of shading in the absence of *Gambusia,* a palm thatch roof similar to the one described above was constructed over a rain water pool without *Gambusia* and without spyrogyra. Again albimanus disappeared in the shade of this cover, although it continued in the portions of the pool which were not shaded. Readings with an exposuremeter indicated a degree of shade under the cover comparable to that under a fairly thick clump of good sized trees of the kind which will be mentioned below.

Another experiment was performed, as follows. Two wooden tubs of approximately one meter diameter and 25 centimeters deep were filled with water and placed, one in full sunlight and one under a group of date palm trees. Both tubs were seeded with spyrogyra, but this plant never was able to develop in the shaded tub, whereas the tub in full sunlight at all times contained an abundant growth. The degree of shade under the palm trees was practically the same as that under the palm leaf thatch roof described above, as was indicated by readings with the exposuremeter. At first *A. albimanus* breeding occurred in both tubs, but after a few days, when presumably the biological situation of the water in the two types of conditions had become adjusted, the breeding disappeared in the shaded tub, but continued in the tub exposed to sunlight.

We believe that in the presence of *Gambusia* the shade is indirectly unfavorable for mosquito breeding, due to the fact that the green algae cannot survive in shaded water, and in the absence of this horizontal vegetation the larvae are easily destroyed by the *Gambusia,* provided there is not too much vertical vegetation. Vertical vegetation is also destroyed by the shade, but not as easily as are the algae. Also it would appear that in the absence of predacious fish the shade itself is un-

---

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

*The studies and observations on which this paper is based were conducted with the support and under the auspices of the International Health Division of the Rockefeller Foundation in cooperation with the Secretariat of Health and Welfare of Cuba.

†Comission de Malaria de Cuba.

Fig. 1

Showing method of making "layerings" from trees of *F. benjamina*. A circular cut is made round base of limb and a small quantity of earth is held around this point by means of sacking. When roots develop the limb may be cut off and planted. The shading of the avenue shown here is comparable to that which will be achieved along protected streams in Cuba when the trees being planted now have reached the growth of those shown above.

favorable for albimanus breeding. Here the shading probably inhibits the growth of diatoms and other microscopic and macroscopic plant life upon which the larvae depend for food.

We are beginning to utilize shading in streams and similar situations where, although *Gambusia* are present, mosquito breeding has been prolific due to the heavy growth of spyrogyra in these waters. In searching for an appropriate shade tree we have considered desirable that the plant have the following characteristics:

(1) It should be a tree which is cheap and easy to secure in considerable numbers.

(2) It should be of rapid growth.

(3) It should be hardy, at least in the climate in which it can survive.

(4) It should be an evergreen tree.

(5) The fruit and foliage should not be edible.

(6) The wood should be of no value for domestic or other use.

If the fruit, foliage or wood of the tree were useful we might expect that the public would destroy at least a certain number of the trees in order to use these parts, and this would of course lessen the value of the tree for our purpose. We have found that the *Ficus benjamina* combines these conditions better than any other shade plant. In its normal geographic range it is a hardy, rapidly growing tree with a thick foliage. It can be grown only where it is not exposed to frost. The foliage is not useful for feed for animals and the wood is of practically no value. The fruit is not edible. Small trees of from one to three meters in height may be easily secured from limbs of older trees by the process of "layering."

In the process of "layering" a circular cut is made around the base of a limb on an older tree. A limb is selected of about two meters length and two to three inches in diameter. The circular cut is carried through the bark to the cambium layer. A few pounds of fertilized earth are tied around the cut portion of the limb with a piece of sack. After about six weeks roots develop from the cut and these grow into the earth. The limb may then be cut off from the tree and planted.

We have already set out more than seven thousand such young trees along the margins of streams in the area where we are carrying out a malaria control project. Practically all of these trees have survived and we expect that within a couple of years they will be shading these streams fairly well. We are also using bamboo (*Bambos vulgaris*) for this purpose. Although this bamboo is hardy, of rapid growth and makes a good shade, it has the disadvantage that the canes are useful to a limited extent and, therefore, a certain number of them may be expected to be cut and taken away by the public. The open joint which remains after cutting the cane forms a cup which may catch rain water and breed mosquitoes. We find *Aedes mediovittata*, *Orthopodomyia signifer* and *Culex quinquefasciatus* in these places, but these cups can easily be eliminated.

Fig. 2

Water course showing double line of *F. benjamina* trees which have been planted to shade the stream. Probably within three or four years adequate shade will be cast by these trees to prevent *A. albimanus* breeding here.

SUMMARY

In Cuba and perhaps elsewhere in the range of *A. albimanus*, natural bodies of water which are well shaded and which are provided with predacious fish are unfavorable for mosquito breeding. This is due to the fact that horizontal and other vegetation does not flourish under these conditions and therefore the larvae have no protection against their natural enemies. In breeding places where *Gambusia* are not present, shade affects adversely *A. albimanus* breeding, perhaps due to its effect on the microscopic organisms which constitute the food of the larvae. In climates where frost does not occur, *F. benjamina* is the most desirable plant for use in shading breeding places and is being employed in the malaria control work in Cuba.

RECENT DEVELOPMENTS IN METHODS OF MOSQUITO CONTROL IN ANTI-MALARIA CAMPAIGNS*

By E. HAROLD HINMAN, PH.D., M.B.
Wilson Dam, Alabama

In a brief report it would be impossible to attempt to review the world literature upon anopheline control. Therefore, only a few of the most interesting contributions from the past two years have been selected. Naturally, a number of equally important ones have been omitted. In the preparation of this review the *Tropical Diseases Bulletin* and the *Review of Applied Entomology, Series B,* have been invaluable in making available abstracts of foreign literature which would not otherwise have been obtainable.

LARVICIDES

Murray[1] made an exhaustive study of mineral oils as mosquito larvicides. His findings indicate that if oil penetrates the tracheae the larvae fail to mature, but the vapor from oils was not necessarily fatal. Anopheline pupae were found very susceptible to oil. Oil films of various ages showed that the penetrating power of the oil usually deteriorates with the age of the film and therefore it is probably not desirable to obtain a film of high durability. In selecting an oil it is desirable to secure one that readily penetrates the tracheae of the larvae (one of medium boiling range), not involatile enough to be markedly viscous, and not volatile enough to irritate the larvae and cause their tracheae to collapse and thereby prevent penetration of the oil.

Rice[2] has described a sprayer, adapted for applying oil by brushing. It is operated by one man and used for oiling streams and seepages. Wafsy[3] has found an acid-oil-sludge from the distillation of crude oil to be an efficacious larvicide. Barber, Rice, and Mandekos[4] have described a dustless method of diluting and spreading Paris green. It is mixed with kerosene and either applied by spraying or else mixed with pebbles or gravel, and the latter broadcast over the breeding area. The kerosene is not used in sufficient quantities to act as a larvicide, but is a vehicle for spreading the Paris green and keeping it afloat.

Voljenski[5] recommended the addition of decomposition products of schists, particularly fractions of tar with a boiling point between 250 and 350° C. with equal parts of petroleum as a larvicide. Shvetz and Lappin[6] experimented with residues from distillation of crude petroleum and found two products with high toxicity for *Anopheles maculipennis* and with considerable stability.

Ul'Yanishchev and Rifling[7] developed oleogumbrin, a waste product of the oil refining industry, as a carrier for Paris green. A much cheaper larvicide was produced by combining oleogumbrin with calcium arsenite in a 1:4 mixture, known as oleoarsenite. The combination was found to float well. Mail[8] found that the addition of a small quantity of thiodiphenolamine to an oil greatly increased its larvicidal potency. Tilli[9] used cyanamide as a larvicide. In addition to killing the larvae, it is also fatal to the ova and pupae. It is furthermore useful as a fertilizer. May[10] believes that hexachlorethane is a valuable larvicide. A mixture of the ground crystals and talc is dusted on the water and the gas produced kills both larvae and pupae. It is claimed that the chemical is not innocuous to valuable aquatic life and that it combines the advantages of oil and chemical larvicides. Kalandadze[11] successfully utilized chloropicrin in the destruction of larvae and pupae, either by spraying or by broadcasting sawdust mixed with chloropicrin. It is believed to be a contact poison and unfortunately kills certain aquatic life. Cawston[12] experimented with chopped leaves of *Opuntia* as a larvicide in Natal. Although the young larvae of both culicines and anophelines were killed, the more mature forms were not destroyed.

DRAINAGE AND ENGINEERING METHODS

Worth[13] has experimented with measures for controlling *Anopheles culicifacies* in river beds in Ceylon. The rocky areas were drained, filled, and sealed. In sandy areas it was necessary to construct dry-weather channels by means of parallel bamboo stake fences along each side of the channel. Check dams were built to prevent the scouring action of the river. DeVerteuil and Spence[14] have described a low tide culvert system in Trinidad for the drainage of coastal marshes. The culverts are concrete, furnished with sluice gates and connect either swamps or rivers with the sea at low tide.

Senior White[15] converted open drains into subsoil drains by deepening them to three feet; flat-sided stones

---

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30–December 1-2-3, 1937.

*From the Malaria Control Division, Department of Health and Safety, Tennessee Valley Authority, Wilson Dam, Alabama.

*Report of the Subcommittee on Entomology of the National Malaria Committee.

were laid to form a tunnel, over which smaller stones, gradually decreasing in size, were laid. The structure was topped off with earth and planted with grass. It was found that the resultant saving paid for the construction in two years. Scott[16] reported the successful elimination of breeding places of *Anopheles minimus* on tea estates by the construction of percolation pits, a form of vertical drainage.

Antoine[17] attempted to control mosquito breeding in rice fields by intermittent irrigation. If the rice field is irrigated for three days in six, then it is dry for twenty-four hours in each interval of six days and breeding thereby prevented. Dryenski[18] also found that interrupted irrigation gave satisfactory control of *A. maculipennis* in rice fields in Bulgaria. During the spring and summer the fields were drained for five to eight days at ten-day intervals. Any small undrained pools with larvae were dusted with Paris green. A village adjoining the treated area had many fewer cases of malaria than a village bordering the control rice fields. Dugdale[19] and Hill[20] observed interrupted irrigation of rice fields as a successful control measure in Portugal.

Williamson and Scharff[21] discuss the advantages of sluicing in the control of *A. maculatus* in Malaya. In flushing out the channels it is believed that the majority of the larvae are either killed outright or are thrown up on the banks by the sluice wave and none are carried down-stream alive.

BIOLOGICAL CONTROL

Russell[22] points out that in Assam plants like tarapat, duranta, hibiscus, and wild fig have been planted along the banks of streams and, where dense shade is produced, *A. minimus* disappears. In a few instances this method has been very effective, but the cultivation of the plants requires close supervision. Blacklock[23] records the successful control of *A. minimus* by growing dense shade in Assam and recommends using similar methods in Africa. Podgurskii[24] also advocated the planting of shade species in Russia to control *A. maculipennis*. DeBoer[25] discusses tree planting for malaria control in swamps.

Kirk[26] states that the planting of a belt of shade trees on each side of rivers and streams in Mauritius to prevent erosion has prevented the breeding of *A. costalis* (*gambiae*). Light shade is almost as effective a deterrent to oviposition as is dense shade. *Eugenia jambos* is the most suitable shade tree. It is believed that the inhibitory action is through the inability of the necessary food organisms for the larvae to develop in the absence of light. However, *A. funestus* prefers dense shade, but is not an important local transmitter of malaria.

Senior White[27] reports experiments with Williamson's "Herbage Cover" method of larval control, which consists of packing shallow water courses with grass and herbage, leaves and twigs intermixed. The method is considered promising and appears to act by a biological means rather than as a form of subsoil drainage as stated by Williamson.

Prashad and Hora[28] group the larvivorous fishes of India into three main divisions: (1) predaceous species, (2) larger species of commercial importance, and (3) small carnivorous species. They also suggest the introduction of a herbivorous fish which would remove the vegetation supplying the food to larvae. Hackett[29] believes that the role of *Gambusia* has been misunderstood. Used as a new and disturbing element, introduced into a delicately balanced community in which an anopheline vector may be barely maintaining itself, *Gambusia* may have a long-term effect which can be appreciated only after many years. Sokolov[30] reports the successful control of anophelines in the fields in Central Asia by *Gambusia*.

HERBICIDES

In the Tennessee Valley Authority the malaria control program for the past two years has included experimental work on the efficiency of various herbicides upon aquatic vegetation known to harbor *Anopheles quadrimaculatus*. Owing to the little information available concerning the poisoning of plants in water, progress has been slow. It is hoped that a feasible technic will shortly be available for the destruction of obnoxious plants present on the margins of these reservoirs, and that this procedure may become standard practice in malaria control activities. To date sodium arsenite, applied as a liquid spray, has been used most widely.

IMPOUNDED WATERS

With the impounding of several reservoirs and the preparation of others, more refined methods for the prevention of malaria are being developed by the Division of Malaria Control, Health and Safety Department of the Tennessee Valley Authority. Especial attention has been devoted to the preparation of reservoirs prior to impoundage, with every attempt being made to present a clean water surface after filling.

With the successful employment of fluctuation of pool level as an antilarval measure, various accessory control procedures have been utilized more extensively. Marginal drainage, shoreline improvement (drift removal), herbicide work, are essential to secure the maximum results of variation of water elevation.

MEASURES AGAINST ADULT ANOPHELINES

Sinton and Wats[31] found an insecticidal mixture composed of one part of pyrocide in nineteen parts of kerosene oil was comparatively cheap and efficacious against one species of adult *Anopheles*, under laboratory

conditions. Wats and Singh[32] compared the efficacy of 65 drugs to that of the above preparation and found them all inferior to the pyrocide-kerosene preparation. Thompson[33] has used James' trapping method, along with pyrethrum fumigation, to destroy large numbers of anophelines in barracks in India.

Wats and Bilderbeck[34] and Senior White, Lal, Adhikari and Swaroop[35] experimented with an automatic mosquito-catching device, the "entoray." Both of these groups of workers concluded that the apparatus was not a practical antimosquito measure, although the ultraviolet rays did attract a few mosquitoes.

Balfour[36] tested screening in the control of *Anopheles sacharovi* in Greece in a hyperendemic area, and believes that a significant reduction of malaria resulted. Dugdale[19] states that screening has been very effective in reducing the incidence of malaria in Portugal. Kadletz and Kuz'mina[37] recommended the destruction of adult anophelines hibernating in or near dwellings of people infected with malaria as a control procedure. Swellengrebel, deBuck, Schoute and Kraan[38] utilized spraying against mosquitoes in houses. Since the operation is expensive and requires trained personnel, they reduced the number of houses sprayed to include only those with four or more children under 16 years of age. This reduced the number of houses to be sprayed to about one-third and destroyed about 94 per cent of infected anophelines. In another area they sprayed only houses with three or more children under 16 years.

Hackett[29] has discussed the importance of animal barriers against certain races of *Anopheles maculipennis* in Europe. In Portugal, Dugdale[19] found certain villages protected by a barrier of rabbit hutches.

BIBLIOGRAPHY

1. Murray, D. R. P.: Mineral Oils as Mosquito Larvicides. Bull. Ent. Res., **27**:289-305, 1936.
2. Rice, E. M.: Antilarval Oil Application by a 'One-Man' Brushing Method. Rec. Malaria Survey of India, **5**:499-500, 1935.
3. Wafsy, Omar: A New Larvicide. Jour. Egypt. Med. Assn., **19**:592-608, 1936.
4. Barber, M. A.; Rice, J. B.; and Mandekos, A.: A Dustless Method of Diluting and Spreading Paris Green in Malaria Control. Amer. Jour. Hyg., **24**:41-44, 1936.
5. Voljenski, L.: Laboratory Experiments on the Application of Schist Products for the Destruction of Mosquito Larvae. Med. Parasit. & Parasit. Dis., **4**:316-320, 1935.
6. Shvetz, S. I.; and Lappin, G. I.: Sur l'Action Larvicide des Produits Residuels de Naphte: Communication Preliminaire. Med. Parasitol., **5**:171-173, 1936.
7. Ul'Yanischev, V. I.; and Rifling, E. A.: A New Preparation, 'Oleoarsenite,' for Control of Mosquito Larvae: Summary. Sci. Res. Work Inst. Plant Prot., 1935, pp. 473-475, 1936.
8. Mail, G. A.: Thiodiphenolamine, a New Ingredient of Mosquito Larvicides. Jour. Econ. Entomol., **29**:1144-1146, 1936.
9. Tilli, P.: Calcium Cyanamide as a Larvicide. Riv. di Malariologia, **16**:54-59, 1937.
10. May, R. M.: Hexachlorethane as a Mosquito Larvicide. Ann. Inst. Past., **57**:325-336, 1936.
11. Kalandadze, L. P.; and Lemer, M.: Sur l'Emploi du Chloropicrine Contre les Larvaes des Moustiques. Med. Parasitol., **5**:568-578, 1936.
12. Cawston, F. G.: Some Observations on *Opunta* Used as a Larvicide. Jour. Trop. Med. & Hyg., **39**:137-138, 1936.
13. Worth, H. N.: The Control of Anopheline Breeding in River Beds. Trans. Roy. Soc. Trop. Med. & Hyg., **30**:521-530, 1937.
14. De Verteuil, E. J.; and Spence, T.: Malaria in Trinidad. Low Tide Culvert System in Coastal Drainage. Trans. Roy. Soc. Trop. Med. & Hyg., **30**:449-460, 1937.
15. Senior White, R.: Malaria Control by Subsoil Drainage at Waltair. Rec. Malaria Survey of India, **6**:13-18, 1936.
16. Scott, D. T.: Malarial Control Measures by Vertical Drainage (Percolation Pits). Proc. Ann. General Meeting Assam Branch Brit. Med. Assn., pp. 22-25, 1936.
17. Antoine, M.: Prevention of Rural Malaria by Intermittent Irrigation of Rice Fields. Bull. Soc. Med.-Chirurg. de L'Indochine, **14**:612-615, 1936.
18. Dryenski, K.: The Influence of Intermittent and Regular Irrigation of the Rice Fields upon Malaria and the Rice Produce. Mitt. Bulg. Ent. Ges., **9**:11-24, 1936.
19. Dugdale, J. N.: Malaria in Portugal. Jour. Trop. Med. & Hyg., **39**:149-150, 1936.
20. Hill, R. B.: The Malaria Problem in Portugal. Sou. Med. Jour., **30**:953-956, 1937.
21. Williamson, K. B.; and Scharff, J. W.: Antilarval Sluicing. Malay. Med. Jour., **11**:123-150, 1936.
22. Russell, P. F.: Malaria in India: Impressions from a Tour. Amer. Jour. Trop. Med., **16**:653-664, 1936.
23. Blacklock, D. B.: Studies in Rural Hygiene in the Tropics. II. The Cultivation of Dense Shade Plants as an Antimalaria Measure. Ann. Trop. Med. & Parasit., **30**:181-186, 1936.
24. Podgurskii, P. F.: Plantage des Arbres au Bord des Collections d'eau Comme Mesure Antoanophelienne. Med. Parasitol., **5**:47-51, 1936.
25. DeBoer, H. S.: Malaria Control in Swamps. Quart. Bull. Health Org. League of Nations, **5**:138-139, 1936.
26. Kirk, J. B.: The Relation of Shade to the Natural Breeding Places of *Anopheles Costalis* in Mauritius. Ann. Trop. Med. & Parasit., **31**:1-6, 1937.
27. Senior White, R.: Williamson's 'Herbage Cover' Method of Larval Control. A Preliminary Note on Some Field Trials. Rec. Malaria Survey of India, **6**:439-445, 1936.
28. Prashad, B.; and Hora, S. L.: A General Review of the Probable Larvivorous Fishes of India. Rec. Malaria Survey of India, **6**:631-648, 1936.
29. Hackett, L. W.: Biological Factors in Malaria Control. Amer. Jour. Trop. Med., **16**:341-352, 1936.
30. Sokolov, N. P.: L'Acclimatisation du *Gambusia Patruelis* en Asie Centrale." Riv. di Malariologia, **15**:325-344, 1936.
31. Sinton, J. A.; and Wats, R. C.: The Efficacy of Various Insecticidal Sprays in the Destruction of Adult Mosquitoes. Rec. Malaria Survey of India, **5**:275-306, 1935.
32. Wats, R. C.; and Singh, J. J.: An Investigation into the Mosquitocidal Value of Indigenous Derris and Other Drugs. Rec. Malaria Survey of India, **7**:109-114, 1937.
33. Thompson, T. O.: Mosquito Destruction by James' Method. Jour. Roy. Army Med. Corps, **67**:331-335, 1936.
34. Wats, R. C.; and Bilderbeck, C. L.: Some Experiments with "Entoray" Machine as an Antimosquito Measure. Rec. Malaria Survey of India, **6**:549-555, 1936.
35. Senior White, R.; Lal, R. B.; Adhikari, A. K.; and Swaroop, S.: Some Experiments with an Automatic Mosquito-Catching Machine: the Entoray. Rec. Malaria Survey of India, **6**: 595-629, 1936.
36. Balfour, M. C.: Some Features of Malaria in Greece and Experience in Its Control. Riv. Malariol., **15**:114-131, 1936.
37. Kadletz, N. A.; and Kuz'mina, L. A.: The Dispensary Method of Controlling Hibernating Anophelines Under the Conditions of a Large Town: Its Value as Compared with Other Methods of Control. Parasites, Transmetteurs, Anim. Venimeux., pp. 264-268, 1935.
38. Swellengrebel, N. H.; deBuck, A.; Schoute, E.; and Kraan, M. H.: Investigations on the Transmission of Malaria in Some Villages North of Amsterdam. Quart. Bull. Health Org. League of Nations, **5**:295-352, 1936.

FURTHER OBSERVATIONS ON AIRPLANE DUSTING FOR *ANOPHELES* LARVAE CONTROL*

By CALVIN C. KIKER†
CHARLES D. FAIRER,‡
and
PAUL N. FLANARY§
Wilson Dam, Alabama

Two years ago Watson reported on the Tennessee Valley Authority's initial experiences with airplane dusting for *Anopheles* larvae control on impounded water through the season of 1934 and 1935.[1] The work during this period consisted largely of experimental dusting along the shoreline of Lake Wilson with an Authority-owned airplane.

The initial work justified the conclusion that large shallow breeding areas could be more economically dusted with an airplane than through use of either boat or hand equipment. In fact, it was realized that the extensive shallow flats in the central part of the proposed Lake Wheeler could not be treated adequately with ground equipment. Consequently, our original plans for *Anopheles* mosquito control for this lake included the use of airplanes for the distribution of Paris green dusts.

Little actual airplane dusting was done during the season of 1936, though a temporary impoundage of several hundred acres in the lower part of the Wheeler Reservoir provided an opportunity for treatment on an acreage basis. Experience gained in treating this relatively small impounding through application of Paris green with the single dusting airplane owned by the Authority served to bring out the need for improving the dusting equipment and for having reserve airplanes always available. The dust discharge was irregular, dust accumulated in the pilot's cockpit, and the plane was out of service for some time due to a wind storm accident. Some of these difficulties have been experienced on other airplane dusting work.[2] To facilitate improvements we studied the airplane crop dusting methods in Texas, Mississippi and Florida where much valuable information was secured. We are indebted to Mr. B. R. Coad, of the Delta Air Corporation, for suggestions and advice. Of particular importance was the fact that we secured a contract with a commercial crop dusting corporation* to supply an airplane and pilot on an hourly basis for dusting on Lake Wheeler during the season of 1937. The contract was highly satisfactory to the Authority in that the continuous service of one airplane was assured; the average hourly cost was not excessive; property damage liability was assumed by the corporation, and the contractors' long experience with airplane dusting was available.

Prior to impoundage, it was estimated that the *Anopheles* mosquito breeding areas in the central part of the reservoir would require the use of two airplanes for treatment at weekly intervals. A sketch of the reservoir will be seen in *Fig. 1*. A slowly receding water level had been scheduled, which would reduce the size of the area requiring treatment as the season progressed.

The airplane owned by the Authority is a Stearman model 4-D open biplane powered by a 300 horsepower engine. It has a dusting speed of about 90 miles per hour with an 800-pound load. This plane was used in our early work, but during the winter preceding the 1937 season new dusting equipment was installed. The dust hopper of plywood construction has a capacity of 21 cubic feet and is located in front of the pilot's cockpit near the airplane's center of gravity. The top of the hopper is curved to conform to the shape of the fuselage. A hatch was provided at the top for loading by a man standing on the wing. The dust is discharged through a short metal throat extending from the bottom of the hopper through the fuselage covering to the venturi. The discharge venturi is of conventional design, having a maximum depth of five inches which may be regulated by raising or lowering the lower section. While dust is fed through the 32-inch slotted opening by gravity, agitation was found necessary for securing a uniform discharge. This is provided by two barrel-type agitators which are driven by a four-bladed wooden impellor located on the lower left wing. The dust release valve is of the sliding type and consists of a one-quarter-inch aluminum plate traveling on brass guides. It is operated from the pilot's cockpit by means of a lever and is calibrated for six different settings. The valve plate closes against a rubber lined valve seat which, with pliable fabric flaps fixed to the inside of the hopper above the valve plate, effectively prevents leakage when the valve is closed.

At full five-inch opening the valve will permit a discharge of seven cubic feet of dust per minute. While the full opening has not been employed on routine work, a high rate of discharge was incorporated in the design for possible future requirements. In some of the earlier experiments we were handicapped on acreage dusting by equipment having a very limited rate of discharge. After experiencing considerable difficulty at the beginning of the season because of dust entering the

---

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30–December 1-2-3, 1937.

†Sanitary Engineer, Malaria Control Division, Tennessee Valley Authority, Wilson Dam, Alabama.

‡Associate Sanitary Engineer, Malaria Control Division, Tennessee Valley Authority, Wilson Dam, Alabama.

§Assistant Airplane Pilot, Malaria Control Division, Tennessee Valley Authority, Wilson Dam, Alabama.

*Delta Air Corporation, Monroe, Louisiana.

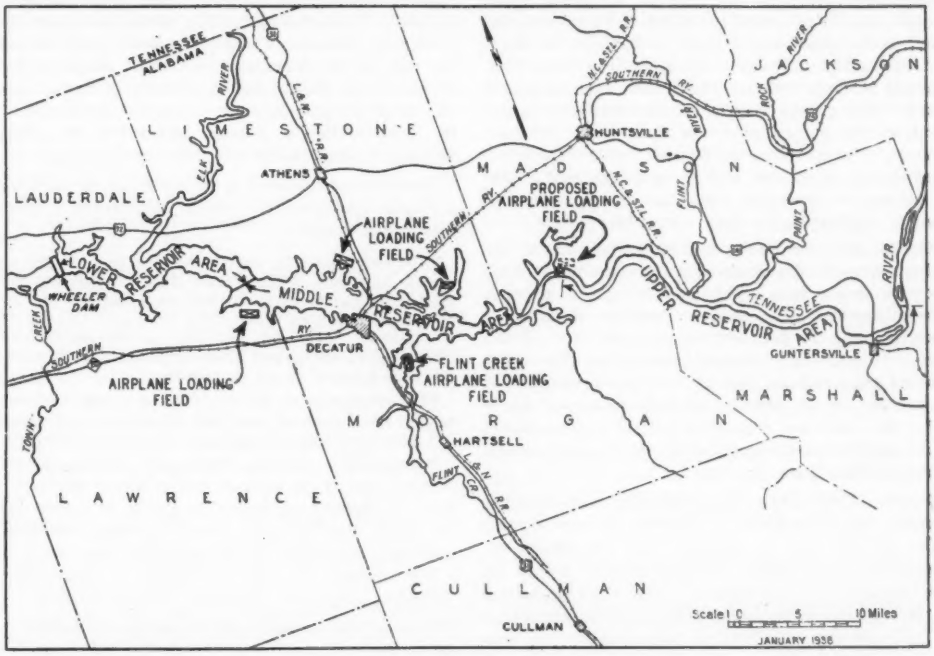


Fig. 1

fuselage at the tail members and traveling forward to reach the cockpit, two dust-tight bulk heads of wood were installed back of the pilot's seat and a third immediately behind the dust hopper, effectively remedying this serious condition.

The airplane supplied on contract was a Huff-Deland open biplane especially designed for crop dusting and is shown in *Fig. 2*. The dusting equipment is somewhat similar to that described above except that only one agitator is used and the hopper has a capacity of sixteen cubic feet. This airplane has thick, high-lift wing sections of full cantilever construction. It is powered by a 200 horsepower engine and has a dusting speed of about 82 miles per hour with a 600-pound load.

Prior to the initiation of routine control dusting, the rate of dust discharge for various valve openings was determined for both planes and calibration charts prepared. The calibrations were based on an assumption that the volumetric discharge of soapstone dust would closely approximate that of the Paris green-soapstone dust mixture to be used. A subsequent check proved this to be true within the limits of the probable error of timing and valve play. It was found on an additional test that the rate varied but little throughout the discharge of a full load of dust. Some reported variations in the rate of dust discharge occurred on routine operations which will be accounted for in the future by installing a stop watch on the valve control lever and recording the actual time required to discharge each load of dust. This will permit immediate correction of any irregularities of dust discharge.

Following the calibration flights the airplanes were

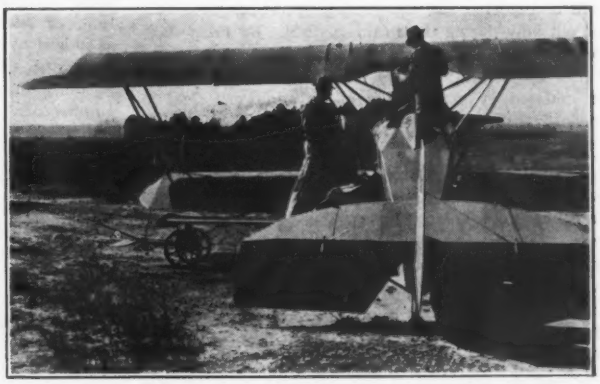


Fig. 2

flown across areas on the airport "gridironed" with greased slides to determine the width of Paris green distribution for given rates of dust discharge at an elevation of twenty to twenty-five feet. The first flight liberated a 20 per cent by volume Paris green-soapstone mixture with a valve opening calculated to give an application rate of one pound of Paris green per acre, assuming a swath width of 200 feet. It had been decided that we would not wish to exceed 200 foot swaths on account of probable waste and the tendency for "spotty" application to occur with wider swaths.

The 510 slides covered by the 200-foot swaths of two flights revealed an average of 1,100 particles of Paris green per square inch, which we believed was in excess of requirements. Accordingly, subsequent flights were made, using a 10 per cent mixture. A total of ten flights, five for each airplane, was made. The seven hundred slides embraced in the 200-foot swaths revealed an average of 435 particles of Paris green per square inch. We, therefore, decided to initiate routine control work with this mixture applied at the rate of one-half pound of Paris green per acre.

Studies of the crop dusting operations indicated the economy and advisability of limiting the non-dusting flying time as much as possible. This was effected by constructing four loading fields on property owned by the Authority and contiguous to areas requiring dusting in the central reservoir area (*Fig. 1*). Through selecting old pastures or cultivated areas, grading of these single rectangular strips, 2,000 feet long by 300 feet wide, was limited to an average cost of about $1,200.00 each. It was estimated that the saving in non-dusting flying time during the first season's operations through the use of these fields would amount to more than their cost of construction. Other important considerations were the closer contact between the pilots and the inspectors, and the conservation of the time of day most desirable for dusting. The observations of other workers confirmed our belief that wind conditions should be taken into account.[3 4 5] It was known that relatively short periods during the early morning and late afternoon occurred when the least wind movement could be expected and our routine operations were carried out only during these calm periods. By using these loading fields, the average distance of flight to the point of dust application was five miles and this will be further reduced by construction of an additional field in the upper part of the reservoir.

Dust storehouses were constructed at each of the loading fields. The idea of mechanical loading was abandoned as a result of the previous experience of the commercial crop dusting organizations. The plan adopted proved to be very satisfactory. It consisted of transferring the sacked dust, by means of a small truck shown in *Fig. 2*, from storehouse to airplane. A loading crew of two or three men living in the vicinity of the field reported for work on short notice or signal from the airplane pilot.

In making preparations for larvicidal work it was believed advisable to remove certain timber along the margins of the reservoir which offered an obstruction to airplane dusting. Chiefly, this work embraced only the removal of single trees and small groups of trees on peninsulas, islands, and at the ends of narrow bays. The work resulted in such an improved operation of the airplanes that it is being included in the original pre-impoundage clearing of other reservoirs.

The Paris green and soapstone used in the dust mixture was purchased in carload lots on the following general specifications:

"The Paris green to contain not less than 50 per cent arsenic by weight with no more than 3½ per cent being soluble in water; of a fineness such that 85 per cent by weight will pass a 300-mesh sieve and 100 per cent a 200-mesh sieve and be toxic to *Anopheles* larvae when applied to natural breeding places and shipped in 100-pound metal drums or cartons.

"The soapstone to be dry, free of lumps or foreign matter, of a fineness such that 98 per cent will pass a 200-mesh sieve and shipped in 50-pound paper sacks."

Representative samples from each lot received were analyzed and in no instance was it found necessary to reject a shipment on account of failure to comply with the above specifications. However, some considerable variations in weights of the materials were noted and it was necessary to make corrections in dust discharge calibration charts for each new shipment of dust.

Prior to the beginning of the season, invitations for bids on a twenty-five-foot capacity, motor-powered dust mixing machine were sent out.* Only one bid was received and delivery could not be made until late in the season; hence it was necessary to improvise equipment for mixing the Paris green and soapstone. This was done through use of a concrete mixer located at Wilson Dam. The operation was attended by a constant nuisance and danger to the workmen, though due precautions were taken and a close physical check maintained on the men. In spite of a costly experience caused by some foreign material entering the dust and resulting in jamming of the dust-release valve on one of the airplanes, and in another case, moisture in the mixer forming lumps and causing uneven dust distribution, an adequately mixed dust was usually provided, as judged by frequent examinations for uniform texture. In mixing, the dust was proportioned by weight; that is, 100 pounds of Paris green was mixed with a given number of 50-pound sacks of soapstone, depending on the strength of the mixture desired. The mixed dust was handled in five-ply, moisture-proof paper sacks† containing about fifty pounds. It was transported to the landing strips in the reservoir by truck. Future transportation costs will be greatly reduced through use of a barge for transporting the mixed dust in quantity from the central mixing plant at Wilson Dam to convenient points near the loading fields.

Lake Wheeler reached maximum elevation for a short

*Robinson Manufacturing Company, Muncy, Pennsylvania.
†Bemis Bros. Bag Co., 270 Broadway, New York, New York.

period during February, 1937. The level was soon lowered, but again reached the top on April 10, where it remained with minor fluctuations until the beginning of the mosquito control season, about May 15. Floods during the winter produced abnormal water elevations in the central and upper reservoir areas, resulting in strandage of drift and flotage. While this was of great benefit, the secondary growth of sprouts and dead herbaceous plants occurring following the initial clearing presented a situation favorable for *Anopheles* mosquito breeding at the beginning of the season, as will be noted from *Fig. 3*. Due to a combination of circumstances, it had not been possible to remove completely all such growth prior to the impoundage, though our program on impounded water contemplates control of *Anopheles* mosquitoes principally through biologic means. It is expected that the ideal may be approached through removal of drift, flotage, and plant growth; and by water level fluctuation. However, experience with other large impoundings, with few exceptions, has shown that such control cannot be accomplished at once. Hence our plan to use larvicides as a temporary control measure.

The situation prevailing in the Wheeler Reservoir at the beginning of the 1937 season had been anticipated and we were ready to apply larvicides. Boat and hand equipment had been provided for applying Paris green dust and oil in the upper and lower reservoir areas along the relatively steep shoreline and narrow breeding areas. A certain amount of boat and hand equipment had been provided as a reserve for the two airplanes dusting the central reservoir area.

Both airplanes were assigned to routine dusting about May 15, and there appeared to be little difference in the dust clouds liberated. The Authority's airplane was selected for dusting areas at considerable distances from the nearest loading strip because of its greater load-carrying ability and speed. The contract plane, owing to its more sensitive controls and "tail-high" flying position, affording greater visability to the pilot, was used in dusting areas nearest the loading strips and other areas more suited to this type airplane. A dust cloud liberated by the Authority's airplane will be seen in *Fig. 4*.

The contract airplane was based on the loading strip just south of Decatur, while the Authority's airplane flew fifty miles to and from Wilson Dam for each day's work. Considering the necessity for making last-

Fig. 3

Fig. 4

minute decisions as to when and where dusting would be required each day, the Authority's airplane was at a distinct disadvantage, being based at such a distance from the field headquarters at Decatur.

On routine dusting the flights were limited to the early morning hours when least wind movement occurred. The height of flying was left largely to the judgment of the pilots, who appeared to be in best position to observe the performance of the dust cloud. The average elevation of the routine flights has been estimated at about twenty-five feet, and 200-foot wide swaths were used as a maximum. In routine operations it was the practice to begin dusting as soon as it was light enough to see, and continue dusting until wind conditions prevented accurate placement of the dust cloud. At intervals wind or weather necessitated postponement of the operations for one or two days. In anticipation of such delay the dusting was scheduled for the first three days of the week. Late afternoon dusting was attempted in an effort to apply dust when there was no dew on the vegetation, but calm conditions occurred for relatively short and infrequent intervals, and we were not able to dust very often at this time.

On the basis of our distribution flight tests, we employed the one-half pound of Paris green per acre rate of application for a short period during the earlier part of the season. After a few days' trial our before-and-after dusting larval counts and increasing number of adult *Anopheles* mosquitoes taken in checking stations indicated that a uniform control was not being secured. The rate of application was increased immediately to approximately one pound of Paris green per acre through employing a 20 per cent by volume mixture of Paris green. Better results were observed and this rate of application was used for the remainder of the season.

While results were encouraging, particularly in open situations, it was found that a uniform control was not secured in dense vegetation. In an effort to secure better control, the airplanes were flown at lower altitudes over such vegetation in the hope that better penetration of the dust cloud would result.

A detailed record of the routine operations was maintained in the form of a pilot's daily flight reports, which listed the amount of dust applied and the location of area treated.

As the season progressed it became evident that we were not securing satisfactory control of mosquito production in the areas of heaviest growth. In an effort to improve the operations, a series of carefully controlled experimental dusting flights was undertaken during the latter part of the season. We were fortunate in securing the services of Mr. H. A. Johnson, Sanitary Engineer with the U. S. Public Health Service, as a consultant. An article describing the details of this experimental work will be found in an early issue of the *Public Health Reports*. In summary it might be said that sufficient information was secured to warrant a continuation of the studies next season. It is believed these should include the effect of liberating various dust mixtures at different heights for the purpose of determining the best concentrations of Paris green and the most effective flying altitude; the effect of drift with special reference to whether the Paris green particles are evenly distributed with the diluent or reach the water surface at different places from the diluent dust particles; the possible influence various diluents may exert on the static electric charges developed on the Paris green particles as they are released from the airplane and observations on the Paris green dust after it reaches the water's surface, with special reference to its availability for larval ingestion.

During the season the two airplanes flew a total of 265 hours and applied 316,000 pounds of mixed dust, containing approximately 80,000 pounds of Paris green. It is estimated that 84,000 acres of breeding area were treated.

Cost figures on the contract airplane are the most representative and the following tabulation of data is presented:

Length of dusting season	140 days
Total dusting days	72 days
Time airplane was flown	195 hours
Average flying time per dusting day	2¼ hours
Extent of treatment (cumulative total)	73,000 acres
Total flying cost	8,350 dollars
Flying cost per hour	43 dollars
Amount of dust distributed per hour	1,300 pounds
Area dusted per hour	373 acres
Total amount of mixed dust per acre (per application)	3½ pounds
Flying cost per acre treated (per application)	11 cents
Dust cost per acre treated (per application)	26 cents
Total cost per acre treated (per application)	37 cents

With boat and hand dusting estimated at 90 cents per acre per treatment, these figures show that airplane dusting is very economical where the acreage requiring treatment is sufficiently large and the non-dusting time is not excessive.

Plans for next year contemplate airplane dusting on Lake Wheeler and Lake Pickwick, which will be impounded in March. This program will be carried out by the use of one contract airplane on Lake Wheeler and the purchase of an additional airplane, which will serve as a reserve unit for the airplane now owned by the Authority in dusting Lake Pickwick.

SUMMARY

An account is given of our further experiences with airplane dusting as a means of controlling anopheline breeding on impounded waters.

A description is given of the airplane used for dusting on Lake Wheeler, and the equipment installed in the Authority-owned plane is described in detail.

The facilities associated with the routine use of the airplane dusting program undertaken in 1937 are given and the dusting technic employed is described.

It was found that a distribution of one-half pound of Paris green per acre would not produce uniformly effective results, but that the use of one pound of Paris green per acre gave satisfactory control of anopheline breeding, except in areas where this breeding was associated with dense vegetation.

As a result of experience gained in the 1937 season, plans have been made for using this type of operation on a larger scale in the future.

BIBLIOGRAPHY

1. Watson, Robert B.: Some Preliminary Observations on Airplane Dusting for Anopheles Larvae Control. Sou. Med. Jour., **29**:862-867, 1936.
2. Covell, G.; and Ffridi, M. K.: Experimental Application of Paris Green from Aircraft. Records of the Malaria Survey of India, **7**:—, No. 1 (March) 1937.
3. Coad, B. R.; Johnson, E.; and McNeill, G. F.: Dusting Cotton from Airplanes. U. S. Department of Agriculture Bulletin No. 1204, Jan., 1924.
4. King, W. V.; and Bradley, G. H.: Airplane Dusting in the Control of Malaria Mosquitoes. U. S. Department Circular No. 367 (April) 1926.
5. Williams, L. L., Jr.; and Cook, S. S.: Paris Green Applied by Airplane in the Control of Anopheles Production. Public Health Reports, pp. 459-480, Reprint No. 1140 (Feb. 18) 1937.

DIFFERENT PHASES OF PERMANENT DRAINAGE FOR MALARIA CONTROL IN MISSISSIPPI*

By NELSON H. RECTOR, C.E.
Jackson, Mississippi

The remains of monuments and buildings constructed by the Roman and Greek governments approximately two thousand years ago, and those of the Egyptians, dating back probably twice that far, demonstrate that these ancient people knew how to erect permanent structures. All engineers visiting Rome marvel at the sight of an aqueduct built approximately two thousand years ago and still furnishing water to the modern city. Had these governments known how to build permanent structures for the elimination of malaria mosquitoes, there is a great possibility that the history of these nations might have been changed.

The Americans, benefiting from the mistakes of the French Government in Panama, demonstrated for the first time that malaria can be controlled over a reasonably large area, and that permanent structures can be utilized for the complete elimination of *Anopheles* mosquitoes. British engineers studied these methods, copied them almost *in toto*, and 30 years ago made use of these methods in the far corners of the British Empire.

Finally, American engineers caught the vision and a few years ago undertook the first permanent malaria control work in the United States.

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

The different phases of permanent drainage in Mississippi are: first, filling of ponds; second, the concrete lining of ditches; and third, the drainage of seepy, marshy areas by the use of underground tile or "French drains."

Under certain conditions, filling is an ideal malaria control method, as it eliminates mosquito breeding areas completely and permanently. This type of work has met with general approval of public health and city officials. In many towns and cities, unsightly areas which had bred mosquitoes for indefinite periods, and which were very difficult or even impossible to drain, have been transformed into parks by filling with garbage, trash, and other debris. Putrescible material should not be used in fly breeding season or should be topped with dirt to prevent fly breeding. The popularity of this work has been due largely to the fact that local officials have reduced their hauling costs, have eliminated the need for oiling, and at the same time have made valuable building lots and beautified the city.

During the last two years, the efforts of this Division have been largely directed toward the study of practical, economical means for lining ditches and for protecting banks in order to reduce maintenance costs. Many different types of inverts have been used and it has been found that a round bottom invert, with the banks covered with Bermuda sod, is the most practical type for our conditions. The term "invert" is understood to mean the bottom lining of an open ditch with durable material. The template used in constructing the ditch is always an arc of a circle. Theoretically, an ellipse would be the ideal shape, but would be difficult to construct.

The first permanently lined ditch in the State of Mississippi was completed in May, 1936, and since that time approximately twelve miles of this type of work have been executed in forty-six Mississippi towns in thirty-eight counties. This program has met with much favor, not only from the general public, but also from engineers and officials of local, state, and Federal governmental agencies. The principal benefits to be derived from this work are: first, the elimination of mosquito breeding areas for long periods of time; second, the reduction in the cost of larvicidal control; third, the protection of culverts and bridge structures; and fourth, the conservation of both public and private property.

These inverts contribute toward the control of insect borne diseases and change unsightly swamps, bayous, and sloughs in such a manner as to enhance the value of adjacent property and beautify the town. In several instances, property owners have converted the ditch banks bordering the concrete inverts into flower gardens.

It has been observed that the water-carrying capacity of culverts and bridge openings is materially increased when concrete or brick inverts are constructed. The increased capacity is due to the removal of obstructions and the reduction in friction, which results in an increased velocity. The University of Mississippi is undertaking studies to determine the exact quantity of

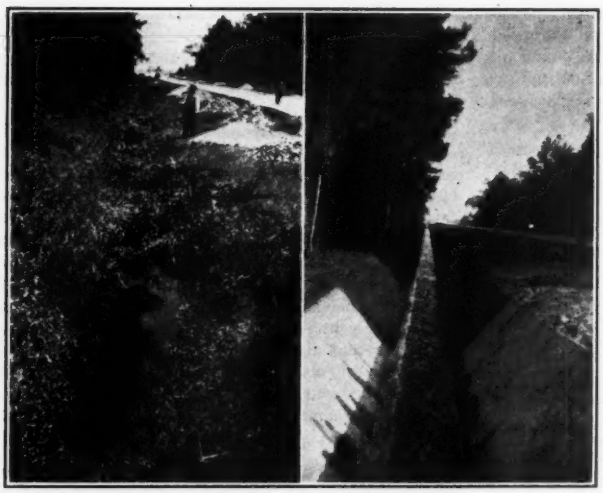


Fig. 1
(Left) Before malaria control. Waveland, Mississippi.
(Right) After malaria control drainage. Concrete invert.

water carried by the Mississippi design on different grades and with varying side slopes.

Experiments have been conducted to determine the minimum amount of material that will be required to construct a satisfactory invert on different grades and on varying sub-grades. Varying sizes and thicknesses of linings and mixtures of concrete have been tried under conditions found in the field.

Experimental inverts have been constructed of asphalt and one section has been in service for sixteen months and is still in good condition.

A blanket Bermuda sod effectively controls erosion even on steep grades and makes it possible to reduce the size of the inverts.

Experiments have been conducted to determine practical means for forcing the growth of sod, and it has been found that wood ash is a satisfactory fertilizer. Last year sod treated with wood ash grew and stayed green all winter; whereas, other non-treated sod did not continue growth. It may be possible further to reduce the size of inverts and to use less riprap above inverts on the outside of curves by stimulating the growth of sod at all seasons of the year.

Where round bottom inverts must join wide flat bottom culverts or bridges, steps are taken to reduce the width through the structure in order to increase the velocity sufficiently to prevent the deposit of silt.

Our engineers are paving intersecting laterals carrying a constant flow of water and sodding the bottom of those carrying intermittent flows to prevent the formation of bars.

When this program for the lining of ditches was first inaugurated, it was believed that the task of securing appropriations for materials from the local communities was almost insurmountable. The fallacy of this belief has been demonstrated, as towns and cities in every section of Mississippi have made and are making liberal appropriations.

If the leading citizens are sufficiently interested in malaria control to demand action, this type of work can be undertaken in practically any town or city in Mississippi. For example, in one small village having a very limited revenue, the officials stated that no money could be appropriated for malaria control. Several months ago, a friend of this Division in this town donated ten dollars for the construction of a two-foot bottom invert, one hundred feet long, adjacent to a public square. The demonstration, as originally planned, stimulated interest, and this village, without further request, appropriated one hundred and fifty dollars for the construction of concrete inverts. This demonstrates that poor, small communities can find cash for materials.

In another village, a storm sewer was constructed through an eleven-foot ridge to drain a seven-acre swamp lying adjacent to the settlement. This community, with a population of two hundred, evidenced its desire for malaria control by expending approxi-

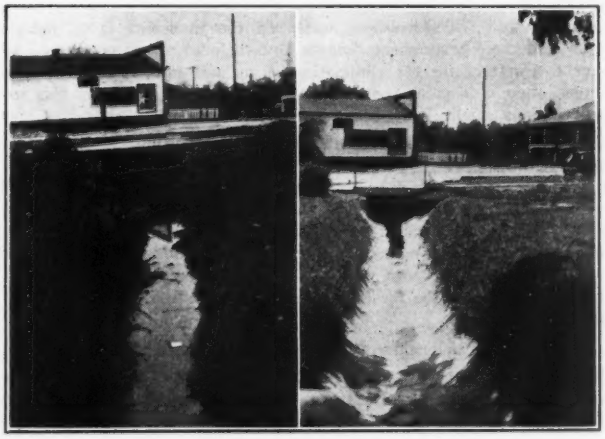


Fig. 2
(Left) Before malaria control drainage. Water Valley, Mississippi.
(Right) After malaria control drainage. Brick and mortar invert.

mately seven hundred dollars on this project. Now cotton and corn are growing where formerly *Anopheles* mosquitoes bred.

Again, in one town in Mississippi where it has been impossible to secure materials, a public-spirited railroad official donated enough material to start the program. The railroad engineer visualized better business as a result of improved health conditions.

Officials of several towns have been so well pleased with the invert program that they have furnished materials and used their street crews for invert construction.

(Top) Before malaria control drainage. Vicksburg, Mississippi.
(Bottom) After malaria control drainage. Brick and mortar invert.

Where it is absolutely impossible to secure cement, brick, poles, rocks and any other type of cheap material available is utilized to prevent erosion on the ditch. Mr. J. A. LePrince, Sanitary Engineer Director of the United States Public Health Service, on a recent inspection trip in Mississippi, reported that the personnel of this Division is utilizing many new types of material for stabilizing the bottom and side slopes of ditches.

Under conditions in Mississippi, the average cost per square yard for concrete inverts 3 inches thick was one dollar and twenty-four cents, of which sixty-four cents was for materials and sixty cents for labor. Brick inverts were laid at an average cost of seventy-seven cents per square yard, of which forty-one cents was for materials and thirty-six cents for labor. The brick used in these inverts were donated. The average cost per square yard of sod in place and fastened down was thirty-two cents. The sod was hauled approximately six hundred feet.

Wherever possible, underground tile properly laid is the method of choice, as such drainage eliminates mosquito breeding and will be effective for a long period of time. Small tile set in broken rocks, brickbats, or gravel has been used in contour ditches to intercept seepage flow. "French drains," constructed of poles set in broken rock, brickbats or other similar materials, have also been utilized.

Several Mississippi towns have received valuable publicity as a result of this work. Pictures of these concrete ditches appeared in the March, 1937, issue of *"Civil Engineering,"* and were shown in lectures delivered at Johns Hopkins and Columbia Universities, Mississippi State College, and other educational centers.

Malaria is a very important disease in Mississippi and has a most important effect on the economic development of the State. The Chairman of the State Industrial Commission will soon be able to advertise the fact that at least one Mississippi town has concreted its important ditches. It is much easier to persuade industries to develop in our State when it is shown that adequate steps are being taken to control malaria.

The interest manifested in the ditch lining program has far exceeded all expectations, and to-day the amount of ditch lining that can be constructed in Mississippi is limited only by the small personnel employed by this Division and by the available WPA labor.

A permanently lined demonstration ditch, properly located, will sell the wide-awake, progressive citizenship on the value of building mosquitoes out.

In years gone by, Madam Anopheles has taken a tremendous toll in Mississippi: first, in lives lost; second, in time lost during illness; and third, in lowered vitality and efficiency. We believe that the time has come when this toll can be checked and eventually stopped by building mosquitoes out. This can be achieved only by hard, consistent work applied over a long period of years.

MALARIA MORTALITY IN THE SOUTHERN UNITED STATES FOR THE YEAR 1936*

By ERNEST CARROLL FAUST, PH.D.†
New Orleans, Louisiana

Once again it has become necessary to take an invoice of the malaria mortality returns for the southern United States as indicated by the 1936 returns. In the summaries made by the writer each year since 1931, it has been pointed out that the mortality data constitute the only malaria records in our territory, which are sufficiently reliable for this purpose. Records of malaria deaths by states and by counties have been received from all of the fourteen states included in this annual resumé, as well as from Illinois, Indiana, and Ohio. Thanks are extended to all of the state departments of health which cooperated.

A brief summary for the year 1936 will first be presented. This will then be correlated with the data for previous years.

The year 1936 showed an appreciable decline in the rate for 1935 in half of the Southern states: in Arkansas, 22.2 vs. 30.4 per 100,000 population; in Kentucky, 1.8 vs. 2.4; in Louisiana, 12.2 vs. 17.1; in Mississippi, 16.32 vs. 25.7; in Missouri, 2.71 vs. 4.7; in Tennessee, 5.3 vs. 8.1, and in Texas, 8.17 vs. 10.8. Four additional states showed essentially no change in the rate: Alabama, 12.0 vs. 12.3; Florida, 21.3 vs. 22.5; South Carolina, 26.0 vs. 24.6; and Virginia, 0.7 vs. 0.6. In three states there was an appreciable (and, apparently, a significant) increase in the rate: Georgia, 19.9 vs. 12.9; North Carolina, 4.73 vs. 2.9; and Oklahoma, 3.71 vs. 2.5. The average rate for the entire fourteen states (with something over 35 millions of people) was 10.2 for 1936, a slight decrease from the rate of 11.0 for 1935.

An examination of the accompanying map (*Fig. 1*) is perhaps enlightening. In this map the changes in the rate are indicated by counties. In the extensive area of endemicity in the eastern portion of the territory the counties with a recorded increased rate are considerably in excess of those with a decrease. This is notably the case in Georgia, North Carolina, and Virginia. While a greater percentage of the total deaths from malaria continues to occur in the coastal portions of Georgia, South Carolina, North Carolina, and Virginia, the southern half of Alabama and the north-central portion of Florida, there is definite evidence of extension of the higher rates into the highlands of the Carolinas and into the northern part of Alabama.

In contrast to the eastern endemic area, the Mississippi Delta area shows a marked decrease in malaria deaths. This is particularly true in the southern portion of the area and in the counties immediately adjacent to the Mississippi river. There is a slight westward extension of the higher rate in northern Arkansas and an apparently significant increase in southern Illinois, north of the junction of the Mississippi and Ohio Rivers. There is also some indication of increased malaria in southern Indiana.

In northeastern Texas and southeastern Oklahoma the heavily malarious counties along the Red River have shown a hopeful recession in the death rate. In Oklahoma, however, increases are noted in counties to the west and north of this area, extending to the Kansas line. In northwestern and southwestern Louisiana (in the oil-producing parishes) there have been uncomfortable increases. Perhaps the most noticeable extension of endemic territory in the western area has occurred in Texas, where many counties in central east Texas have experienced increased malaria deaths.

Considered over a period of years, death rates for malaria by states within the Southern territory have now been accumulated for the period from 1925 through 1936, covering two nearly complete minor cycles of fluctuation. The first cycle included the years 1925 to 1931. The second cycle began in 1932 and, as a whole, will probably be completed in 1937. The peak of the first cycle was reached in 1927 in Arkansas, Louisiana, and Oklahoma; in 1928 in Mississippi, South Carolina, and Tennessee; in 1929 in Alabama, Florida, and Georgia. The second peak was reached in 1933 in Arkansas, Louisiana, Mississippi, and Missouri; in 1934 in Florida, Oklahoma, and Tennessee; in 1935 in Texas. It will not be possible to determine whether or not the peak of this second cycle has been reached in 1936 in Georgia, North Carolina, and South Carolina until the 1937 returns have been tabulated.

The average for the entire population for the fourteen states shows that the first cycle produced its greatest mortality in 1929 (average rate, 9.9), while the bottom of the trough occurred in 1932 (rate, 6.8). Since 1933 the average rate has remained fairly constant (1933 rate, 11.2; 1934 rate, 11.2; 1935 rate, 11.0; 1936 rate, 10.2).

If the records are taken at their face value, and if factors not subject to present analysis are relatively unimportant influences on the records, the following conclusions may be drawn. (1) There is a higher average malaria mortality rate in the southern United States today than there was ten years ago, and a significantly higher average rate than there was in 1932. (2) By deduction, there is more malaria in this territory than there was ten years ago. (3) Malaria is extending from heavily endemic foci into areas not significantly

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

†Department of Tropical Medicine, Tulane University of Louisiana, New Orleans.

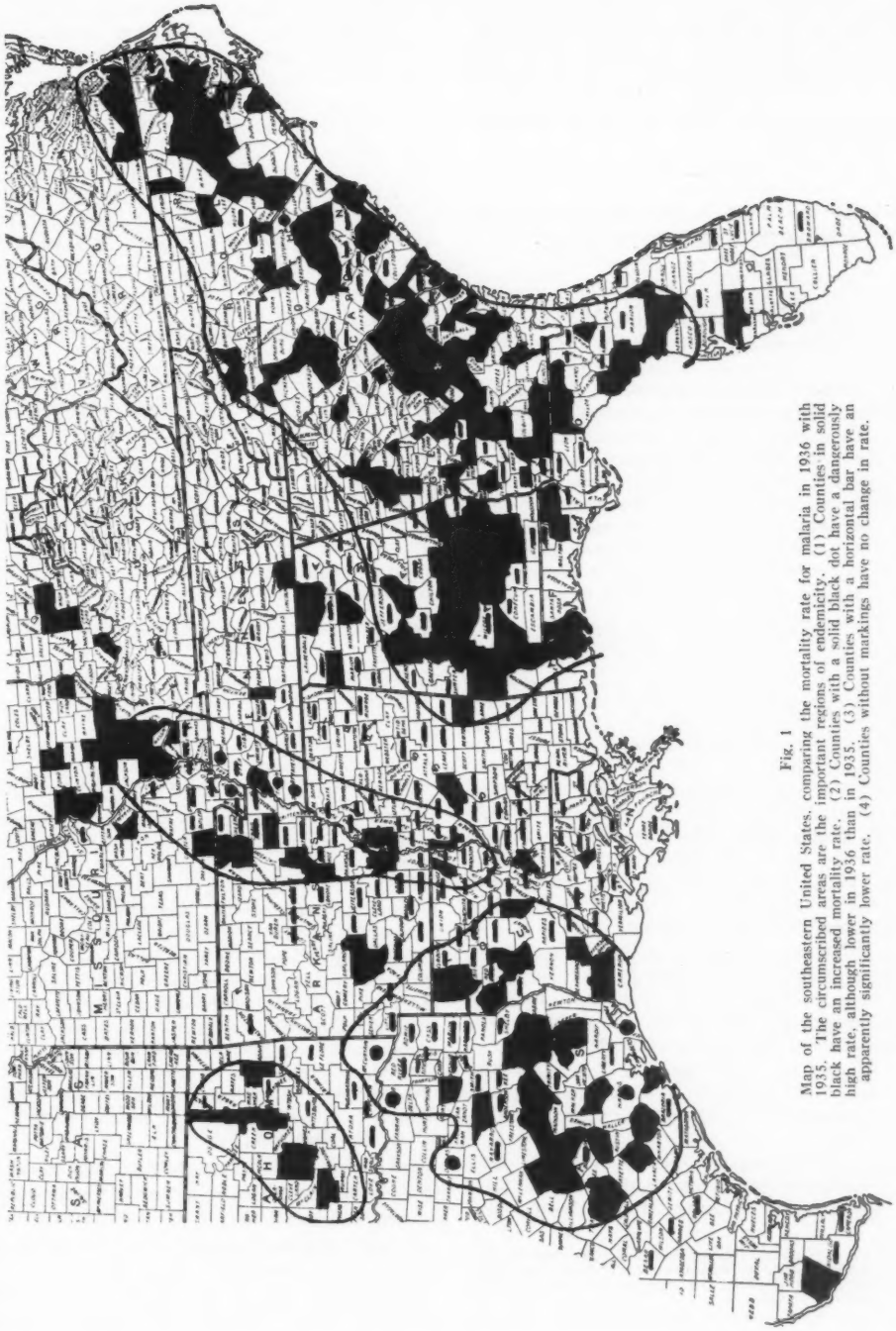


Fig. 1

Map of the southeastern United States, comparing the mortality rate for malaria in 1936 with 1935. The circumscribed areas are the important regions of endemicity. (1) Counties in solid black have an increased mortality rate. (2) Counties with a solid black dot have a dangerously high rate, although lower in 1936 than in 1935. (3) Counties with a horizontal bar have an apparently significantly lower rate. (4) Counties without markings have no change in rate.

malarious a decade ago. (4) The factors which are influencing the spread of this disease and those in particular influencing the cyclic fluctuations of the death rate are essentially unknown. (5) In spite of increased efforts to control this disease, malaria is again becoming an increasing menace to life and to economic development in the South.

REPORT OF THE SUBCOMMITTEE ON MALARIA PREVENTION ACTIVITIES, 1937*

By L. L. WILLIAMS, JR., M.D.†
Washington, District of Columbia

The Chairman is pleased to present a most sanguine report on malaria prevention activities during the year 1937. A state-wide malaria control plan, covering organization and procedure, was adopted by the Southern state health departments. Under the stimulus of social security funds a large number of adequately trained personnel has been added to state malaria control units both in the field and laboratory. The front against malaria appears more formidable than ever before in the history of malaria control in the United States.

MALARIA CONTROL ACTIVITIES

State Health Department Malaria Control Units.—Fourteen state health departments in the malaria belt reorganized and enlarged their malaria control units. In most cases these units are comprised of a physician, an entomologist, a public health engineer, and thick film technicians. These units will conduct epidemiological studies for the primary purpose of locating the endemic foci of malaria in each county. They will carry on entomological investigations, make engineering surveys and cost estimates for malaria control at each focus of infection. Thus the state supplies the local county health authorities with scientifically accurate information upon which to base their control program.

To meet the need for trained personnel in this sudden expansion, provision was promptly made to give specialized training to 34 new workers. Two schools were held of three months each and the following stations devoted the lion's share of their summer's time to instruction:

(1) Henry Rose Carter Memorial Laboratory Malaria Investigations, U. S. Public Health Service, Savannah, Georgia, under Senior Surgeon T. H. D. Griffits.

(2) Station for Malaria Research, The Rockefeller Foundation, International Health Division, Tallahassee, Florida, under Dr. Mark F. Boyd.

(3) Health and Safety Division, Tennessee Valley Authority, Wilson Dam, Sheffield, Alabama, under Dr. E. L. Bishop.

(4) Bureau of Entomology and Plant Quarantine Laboratory, U. S. Department of Agriculture, Orlando, Florida, under Dr. W. V. King.

In addition to the schools mentioned, Miss Aimee Wilcox, Senior Microscopist, U. S. Public Health Service, gave courses of instruction in thick film technic to laboratory workers at several state health department laboratories and held a school at the Savannah laboratory. Approximately 75 technicians were thus trained in thick film microscopy. Toward the end of the season, with all of the personnel returned to their respective states, intensive work was begun in making autumn blood indices.

Works Progress Administration Malaria Control Drainage Program.—The Works Progress Administration's malaria control drainage program was continued throughout the year in cooperation with sixteen state health departments and the U. S. Public Health Service. The Public Health Service continued to furnish technical supervisory personnel to state health departments on the basis of the relief labor employed on the projects.

The following table sets forth the work accomplished during the twelve month period ending October 31, 1937.

WPA MALARIA CONTROL DRAINAGE PROGRAM ACCOMPLISHMENTS

State Health Departments and Public Health Service Cooperating

Daily average number of laborers	16,300
Drainage ditch, miles	3,102
Water surface drained, acres	67,051
Persons living within Anopheline flight range	1,568,000

Maintenance of Drainage Systems.—The importance of maintenance of malaria control drainage systems is worthy of emphasis. Both Federal and state research continues on the economics of ditch lining and its relation to ditch maintenance. Permanent lining of ditches is becoming increasingly popular in some states.

Impounded Water.—Enforcement of state health departments' artificially impounded water regulations was continued. A number of pre-impoundment surveys were reported. Mosquito control at power and industrial impoundments were also continued. The states of North Carolina and Mississippi reported the adoption of impounded water regulations. This brings the total of states having such regulations to nine, all of which are east of the Mississippi.

Laboratory.—Most of the Southern state health department laboratories were augmented by the addition of thick film technicians. If no addition to personnel was made, designated members of the laboratory were given thorough instruction in the subject.

Several states reported encouraging the use of this technic by private physicians for diagnostic purposes.

---

*Read before National Malaria Committee (Conference on Malaria), meeting conjointly with Southern Medical Association, Thirty-First Annual Meeting, New Orleans, Louisiana, November 30--December 1-2-3, 1937.

†Chairman, Subcommittee on Malaria Prevention Activities, 1937.

In addition Mississippi reported the training of thick film technicians in a number of private laboratories.

Coordination.—The Subcommittee on Drainage Policy and Projects, National Resources Committee, which reconciles conflicting Federal policies on drainage and water storage, continued to function satisfactorily. This subcommittee recently recommended a national state and local policy on drainage and water storage, which will appear in the next report of the parent committee on drainage basin problems and programs. In addition, there will be recommended a policy on water management in the case of multiple uses of water, which will take into account the necessity for malaria control at artificially impounded waters.

The Public Health Service requested information from the health departments of states in the Ohio and Mississippi River Valleys on malaria hazards likely to be created at the proposed flood control reservoirs in those basins. This information is to be used in coordinating the various phases of these projects.

The Public Health Service informed the state health departments concerning the revision of the drainage basin problems and programs report of the National Resources Committee. Attention was invited to the desirability of attending conferences of the local basin committees at which malaria control projects were considered.

Legislative.—North Carolina is now requiring malaria morbidity reports.

The Alabama Legislature recently passed an enabling act for the collection of taxes for county-wide malaria control.

RESEARCH ACTIVITIES

The Tennessee Valley Authority continued to collect valuable data on malaria control at artificially impounded waters. It reports improvement of larvicidal equipment and progress in the investigation of herbicides. Refinements in pre-impoundment basin preparations have been worked out. Pool level fluctuation control was reported as highly successful. The Authority reported investigations on airplane dusting; *Anopheles quadrimaculatus* trapping, flight range, and annual broods; and biological control methods.

The Rockefeller Foundation continued research in parasitology, and conducted studies of the susceptibility of the Nearctic *Anopheles quadrimaculatus* and the Neotropical *Anopheles albimanus* to strains of *P. vivax* and *P. falciparum* from both regions. *Quadrimaculatus* was reported highly susceptible to *vivax* and *falciparum* derived from both regions, while *albimanus* from Cuba and Panama were reported highly susceptible to strains of both species of parasites derived from their own region, but were distinctly refractory to strains of the same species from the Nearctic region.

The Foundation also reports employment of *P. knowlesi* in malaria therapy. They have demonstrated that rhesus monkeys with a chronic infection of *P. knowlesi* possess in their blood serum immune substances which exert a protective effect when such serum is administered to normal animals following inoculation, and that the potency of such serum from immune animals can be enhanced by superinfection. The Foundation continued its work in research in malaria therapy in the treatment of neurosyphilis.

State health departments conducted research on various types of permanent ditch construction. One practical contribution was from Mississippi in the use of wood-ash as a fertilizer for sod on ditch banks.

The Public Health Service's researches comprise: (1) permanent lining of ditches at the Memphis station; (2) observations on the ecology of *A. walkeri* at Reelfoot Lake; (3) studies at Miami on the prevention of airplane convection of mosquitoes into the United States from foreign countries; (4) continued studies of the malaria parasites and malaria therapy of paresis at Columbia; (5) studies on the biological control of *A. quadrimaculatus* at Savannah; (6) entomological studies of the *Anopheles* of the Caribbean.

Southern Medical Journal

JOURNAL OF THE

SOUTHERN MEDICAL ASSOCIATION

Copyright, Southern Medical Association, 1938. Published monthly by the Southern Medical Association, Empire Building, Birmingham, Alabama. Annual subscription, $4.00. Single copies, 35c each.

Entered as second-class matter at the Post Office at Birmingham, Alabama, under Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized December 20, 1921.

M. Y. DABNEY, M.D., Editor
EUGENIA B. DABNEY, M.S., Associate Editor
C. P. LORANZ, Secretary, Treasurer and General Manager

Volume 31 JULY 1938 Number 7

EDITORIAL DEPARTMENT

SOUTHERN MEDICAL ASSOCIATION
Thirty-Second Annual Meeting
Oklahoma City, Oklahoma, November 15-18, 1938

TRAINING OF THE PUBLIC HEALTH OFFICER

There is no uniform Federal law on the educational requirements of health administrators. This regulation is left to the various states, and health legislation in these is as different as are the marriage and divorce laws of such states as South Carolina and Nevada. In Alabama, the health department is controlled entirely by the state and county medical societies, which make all appointments. In some states the entire setup is political, and subject to change at each state or municipal election.

Despite this fact, the majority of full time men working as public health officers in the United States have M.D. degrees, and many have, in addition, a degree in public health.[1] This is evidence of a rather uniform public opinion that the medical profession should direct preventive health measures.

All state health officers have the M.D. degree, but this is not true in the cities. Among the health officers of cities of fifty thousand or more population, a few have no degree at all. Among the smaller cities, a considerably larger number are not physicians. Three-fourths of the health officers who have no degrees, according to Meleney,[1] of Vanderbilt University Medical School, are to be found in three northeastern states. The South is generally considered to be the backward section of the country in public health work. Southern states have usually a lower per capita expenditure in preventive medicine. However, in the particular of academic training of its health officers, the South would appear to be as advanced.

Different parts of the United States, as Meleney notes, present enormously different geographic conditions, concentrations of population, and consequently varied public health problems. Malaria, hookworm and pellagra, common difficulties of the Southern States, need receive little attention in the north. An understanding of engineering and sanitation is peculiarly necessary in warm climates. The venereal diseases are common to all sections, and require a knowledge of sociology as well as medicine.

The field of preventive medicine is expanding more rapidly perhaps than any other medical specialty, and the desire is widespread among physicians who go seriously into the work to secure additional special preparation after the usual four year medical course. There is no doubt that the health officer needs both an M.D. degree for the understanding of medicine and special training in means of prevention of diversely combatted diseases. Other essential qualifications are unquestionable personal integrity, and the ability to sell his ideas to the public and to his medical associates. The health director needs to be a good advocate since wherever he works he must secure willing support of the public and the medical profession. Meleney's recent analysis of present conditions is of much interest.

BREAST TISSUE AFTER ESTROGEN INJECTIONS

Since the development of the mammary gland is closely dependent upon ovarian function, its abnormalities should reflect those of the ovary or be reflected in that organ. A disturbance of the ovary should be associated with a change in the breast and vice versa. Certain clinical cases of advanced breast cancer have shown a surprising temporary regression after irradiation

1. Meleney, Henry E.: Certain Criteria in the Qualifications and Preparation of Health Officers. Amer. Jour Public Health, **28**:423 (April) 1938.

of the ovaries.[1] Treatment of animals with the estrus inducing hormone of the ovarian follicle is followed by structural changes in the breast which suggest certain human mammary diseases. Astwood, of Boston, and Geschickter,[2] of Baltimore, have published excellent microphotographs of the appearance of the breast of young rats treated with several different glandular materials. The pictures are of much pathologic interest, and this method of investigation should be of interest to students of the normal and abnormal development of the human breast.

The response to estrogen injection varies with the species of rat and with individuals. In a strain in which the females are susceptible to breast cancer, the males may be made susceptible by estrogen treatment, so that they develop malignancy of this gland as readily as do the females.

In very young rats, the histologic appearance of the male and female breast is the same. As the ovary becomes active, the lacteal ducts of the female gland extend rapidly with much multiplication of the finer branches. The male breast shows thicker, less finely divided branches. Treatment of the males with estrogen results in a finer branching of the ducts, so that they are like those of the females. Following large or prolonged dosage with estrogen, the ducts become short, wide and irregular, with development of cysts, which later contain papillomas. The picture resembles that of Schimmelbusch's disease in human beings, or chronic cystic mastitis. The cysts are lined with epithelium. At first they are in direct communication with the ducts and contain the same secretion. As they become larger and older, the lining thickens, a thick wall of fibrous tissue may surround them, and the original communication with the duct is lost. The picture suggests that of Bloodgood's blue domed cyst.

Testicular hormone likewise stimulates the breast, but its effects are different from those of estrogen. It causes an increase in the epithelial lining of the ducts. Progesterone, the corpus luteum hormone, did not affect the rat's breast structure. Injections of anterior pituitary-like sex hormone caused a picture in the rat breast like that of pregnancy, and inhibited the customary effects of estrogen if this hormone were injected at the same time. Cyst formation did not occur. Human chronic cystic mastitis, according to Astwood and Geschickter, is benefitted by pregnancy. Since anterior pituitary sex hormone is greatly increased in pregnancy, and since experimental treatment with this hormone causes typical pregnancy changes in the rat's breast, the authors suggest that it might be beneficial in human chronic cystic mastitis.

The response of tissues to hormone injection of course varies considerably with different species of animals. The effect of estrogen on rat mammae can be taken only as interesting and suggestive of a line of further study.

1. Editorial. Radiation of the Ovaries for Cancer of the Breast. Sou. Med. Jour., **31**:571 (May) 1938.

2. Astwood, E. B.; and Geschickter, C. F.: Arch. Surg., **36**: 672 (April) 1938.

GLEANINGS FROM RECENT JOURNALS

Blood Changes in Metrazol Convulsions.— The humane treatment of the insane began in England more than a hundred years ago. Instruments of restraint such as the manacle, chains and straight jacket were discarded, and occupational therapy began. The Germans, years later, considered the method of non-restraint to be linked with peculiar political and social conditions in England, and unsuitable for use on the continent. The French, in 1885, still restrained the insane by force. Non-restraint is now the approved method in most countries, though according to Messinger and Amdur,[1] the commonly used "sedative hydrotherapy," or neutral wet packs, are but a form of disguised restraint, and chemical restraint, that is, the administration of narcotics, must come under the same category.

The recently popular insulin shock treatment, and convulsions induced by metrazol, should come under the classification also of forcible restraint, though they are not used for that immediate purpose. They are certainly a temporary violent control of the patient.

Blood chemical studies made during metrazol convulsions give values as extreme as those found in agonal states, according to Illinois investigators.[2] There is marked acidosis characterized by a rise in the blood lactic acid from a normal of 10 to 30 milligrams per cent to

1. Messenger, E.; and Amdur, M. K.: Abstract of One Hundred Years of Non-Restraint. Amer. Jour. Psychiat., **94**:1307 (May) 1938.

2. Maurer, S.; Wiler, H. O.; Marberg, C. M.; Skorodin, B.; and Fisher, M. L.: Blood Chemical Changes Occurring in Treatment of Psychogenic Mental Disorders by Metrazol Convulsions. Amer. Jour. Psychiat., **94**:1355 (May) 1938.

100-160 milligrams per cent in 3-16 minutes. The glucose rises. The carbon dioxide combining power falls, and inorganic phosphorus rises 100 per cent. These chemical changes are constant for this type of convulsion. In epileptic convulsions, the reverse condition is found in the blood: the pH shifts toward the alkaline side. During metrazol therapy, the pH reaches the lowest point compatible with life.

One wonders where the lapse of a century will classify the convulsion therapies.

Poliomyelitis After Vaccination.—In 1934, Kolmer's ricinoleated virus for prevention of infantile paralysis was announced and during the summer of 1935 it was administered to more than ten thousand individuals. A few cases of poliomyelitis developed soon after vaccination, and the use of the product was stopped. Many thousands of children, of course, had taken it without harm. Rosenberg,[1] of Newark, New Jersey, reports the occurrence of a case of the disease, and of severe paralysis in a four-year-old child in the summer of 1937, two years after it had received the prescribed injections of Kolmer's vaccine. The product thus was totally ineffective in this instance in inducing immunity. It had been considered in some quarters effective though dangerous.

TWENTY-FIVE YEARS AGO

From Journals of 1913

Treatment of Syphilis with Distilled Water.[2]—"The treatment for syphilis recommended by Stephens consists of the hypodermic injection of 6 to 10 c. c. of distilled water every three days for two to four weeks. He was induced to give this treatment a trial as the result of some research work on surface tension. He claims that the addition of distilled water to blood corpuscles so affects the osmotic pressure as to cause a passage of water into the cell, which gets larger and eventually scatters its contents. In disease the rapid catalytic changes and the rapid production of antibodies are interdependent. * * *

"In such a chronic disease as cancer it seemed to Stephens that the process was allowed to continue owing to the absence of sufficient antibodies. * * * Knowing of no vaccine to induce this antibody effect, it occurred to him that the injection of distilled water might bring about the osmotic effects * * * in any similar disease of less malignancy their effect ought to be still better. * * * The Wassermann reaction * * * is but a very roundabout way of determining the surface tension at which hemolysis occurs."

Test for Dementia Praecox.[1]—"The technic of Abderhalden's serodiagnosis for dementia praecox * * * is based on the method of diagnosis for pregnancy. * * * In pregnancy the serum contains ferments capable of digesting placenta or fetal products. * * * These are therefore mixed * * * with the serum and subjected to dialysis. * * * In the test for dementia praecox the author used pulped-up testicles with some serums, on the theory that the affection is connected in some way with the presence of incompletely digested products from the sexual organs. In other cases he used brain tissues in the same way."

Dysmenorrhea.[2]—"An experience of two and a half years with the nasal treatment of dysmenorrhea shows that in about one-half the number of cases so treated the final results are favorable. * * * the relief is prompt and permanent after three or four caustic applications to the nasal spots during a menstrual interval. I have treated sixty-six cases."

1. Rosenberg, Charles: Poliomyelitis Occurring Two Years After Vaccination Against the Disease. Report of a case. Jour. Pediat., **12**:507 (April) 1938.

2. Stephens, G. A.: Distilled Water vs. Salvarsan in Treatment of Syphilis. Brit. Med. Jour., No. 2727:698, 1913. Abst. J.A.M.A., **60**:1399, 1913.

1. Queries and Minor Notes. J.A.M.A., **60**:1727, 1913.

2. Brettauer, J.: J.A.M.A., **60**:1736, 1913.

Oklahoma City — Where We Meet

OKLAHOMA CITY, CROSSROADS OF THE NATION*

"The crossroads of inspiring opinion in the Southwest, where one may see in the course of time the parade of prominent personalities of the state and nation."

Radio Station WKY, Oklahoma City, carries each Friday from 1:00 to 1:30 p. m., the program of the regular Friday Forum Luncheon of the Oklahoma City Chamber of Commerce, which broadcast opens with the explanatory statement quoted above.

The word "crossroads" in the announcer's greeting to the air audience suggests the theme for this chapter of "Oklahoma City—Where We Meet." For truly is the city where we meet for the Southern Medical Association's 1938 convention a crossroads, not only of "inspiring opinion in the Southwest," but of trade and of travel in the Southwest and in the nation.

The observer who remarked that "time flies, and he who would save time must fly also," will find Oklahoma City's situation entirely to his liking. Mileage tables show Oklahoma City almost exactly equidistant from Los Angeles and New York. Should anyone attending the convention in November receive a hurry-up call to either coast he could complete the trip during

*Prepared by the Publicity Department of the Oklahoma City Chamber of Commerce for the Southern Medical Journal.

the same day, or he could go to Mexico City or to Winnipeg instead. Sixteen in-bound and out-bound air schedules are available daily. Should he be not quite so hurried, he will find rail schedules to meet his needs, or he may use any of twelve Federal highway outlets, as many as would be at his service in any city in the United States.

Few cities in the country have had as interesting a transportation history as has Oklahoma City. Before the advent of air mail and express and motor freight this distinction was not only interesting but important, in fact vital. Oklahome City has become a wholesale distributing point for a wide trade area, only after a struggle against adverse rate situations that would have been baffling to a community with less indomitable spirits at the helm in trade development.

When Oklahoma City was accorded a place in the sun by reason of the opening of the "Oklahoma Country" to white settlement, the territory opened was traversed by only one railroad and, naturally, was unknown in tariff sheets. Freight rates, which govern the pulsation of the life-blood of trade, recognized thriving commercial centers on the south, north and east, like Dallas and Fort Worth, Wichita and Fort Smith, but, for this reason, and for a score of years and more, rate adjustments were maladjustments as far as Oklahoma City was concerned.

Aerial view of downtown Oklahoma City.

Hides from animals killed within fifty miles of Oklahoma City could go 350 miles to Kansas City cheaper than to Oklahoma City. Fertilizer materials from packing plants in Wichita, Kansas, 175 miles north of Oklahoma City, could be shipped through Oklahoma City to Shreveport, Louisiana, on a lower freight rate than would be paid by a car of the same material shipped from Oklahoma City plants, hauled to Shreveport by the same engine and in the same train as the car from Wichita. Wheat grown in northwestern Oklahoma could be hauled in wagons for 50 or 100 miles west, across the border into the Texas Panhandle, and shipped back through the farmer's home town and on to Galveston for export on a lower freight rate than would apply from the station in Oklahoma nearest to where the wheat was grown.

While the railroads necessarily were made defendants in Oklahoma City's complaints against the then existing rate situations, often they were not, as a matter of fact, opposed to the necessary readjustments. However, in many instances, they were helpless to do anything about it. Some railroads serving Oklahoma City also served numerous other trade centers. Industries with branch establishments in Oklahoma City, in many cases, did not have plants in Fort Worth or Wichita. Firms with plants in Fort Worth, for instance, but not in Oklahoma City, but reaching markets in other states via lines serving Oklahoma City industries, would punish rail lines that attempted to relieve Oklahoma City's plight by diverting their traffic from Fort Worth to other carriers. Naturally, this had the effect of causing the railroads serving Oklahoma City to readjust rates advantageously to Oklahoma City only when compelled to do so, and the general readjustment necessary before Oklahoma City could compete fully with her rival trade centers in adjoining states took many hearings lasting many years.

These facts and conditions are described only to emphasize the fact that "Oklahoma City—Where We Meet," is a community of initiative, resourcefulness and determination to brook no obstacles in becoming the kind of city that its founders, a considerable number of whom still call it home, envisioned years ago and have had constantly before them as the objective for their efforts and their sacrifices.

Located at the crossroads of air, rail and highway transport, Oklahoma City is also a citizenship cross-section of America. Call the roll of states represented in any gathering of a few hundred Oklahomans and practically every state will respond. Certain it is that when the Southern Medical Association meets in Oklahoma City in November few will be present who cannot, by looking around a little, find themselves among former citizens of their own home state, if not among personal acquaintances of other years.

Book Reviews

The Management of Fractures, Dislocations and Sprains. By John Albert Key, B.S., M.D., St. Louis, Missouri, Clinical Professor of Orthopedic Surgery, Washington University School of Medicine, and H. Earle Conwell, M.D., F.A.C.S., Birmingham, Alabama, Consulting Orthopedic Surgeon to the Tennessee Coal, Iron and Railroad Company, and the Orthopedic and Traumatic Services of the Employees' Hospital, Birmingham, Alabama. Second Edition. 1246 pages, illustrated. St. Louis: The C. V. Mosby Company, 1937. Cloth $12.50.

This new edition is well justified both by the success of the first, published only three years previously, and by a thorough revision of much of the text, especially that pertaining to certain methods of treatment recently undergoing rapid development, such as those in fractures of the spine and hip. About one hundred pages have been added and most of the chapters have seen more or less change. The same arrangement of subjects has been retained. The new volume is more attractive as well as more complete and thoroughly up-to-date.

The chapter on "Fractures of the Skull and Brain Trauma," by the late Dr. C. E. Dowman, has been revised by his former assistant, Dr. Edgar F. Fincher, and that on "Fractures of the Jaws and Related Bones of the Face," by Dr. James Barrett Brown, has been rewritten and much enlarged. As in the previous edition, there are chapters on the very practical and interesting subjects of "Workmen's Compensation Laws and Medico-legal Aspects of Fracture Cases." The subject of "Rupture and Herniation of the Intervertebral Discs" is discussed rather briefly.

As stated in the preface, this book is intended for the student, the general practitioner and the surgeon. It fulfills its purpose admirably as a practical working guide on the subjects covered. It is easily one of the best textbooks that have appeared in this difficult field of surgery.

Practical Bacteriology, Hematology and Animal Parasitology. By E. R. Stitt, M.D., Sc.D., LL.D., Rear Admiral, Medical Corps, and Surgeon General, U. S. Navy, Retired; Paul W. Clough, M.D., Chief of Diagnostic Clinic, Johns Hopkins University; Associate Professor of Medicine, University of Maryland; and Mildred C. Clough, M.D., Formerly Fellow in Bacteriology and Instructor in Medicine, Johns Hopkins University. Ninth Edition. 961 pages, illustrated. Philadelphia: P. Blakiston's Son & Co., Inc., 1938. Cloth $7.00.

For many years Admiral Stitt's book has been a standard work of reference. Designed especially as a handbook for the medical officer who may find himself stationed far from any well-equipped laboratory or library, it has covered a wide field thoroughly. It is in fact several books in one and this reviewer knows of no one volume more solidly packed with useful and authoritative information. The present ninth edition has been revised through the collaboration of the Drs. Clough. It has been largely rewritten and considerably amplified. Very wisely, the direct style and brevity of statement have been preserved so that the essential facts upon many subjects are preserved clearly in a space that, despite the breadth of coverage, still allows the book to be of handy size. The 12 chapters of Part I condense bacteriology into 290 pages that provide a complete and up-to-date survey of the field not only in its purely technical aspects, but also in the application of its facts to the problems of clinical diagnosis and treatment. Part II, Hematology, has been greatly expanded. It covers the whole field of methodology and adds valuable interpretations as well as resumés of the clinical findings in blood dyscrasies. Part III deals with Animal Parasitology in its broadest sense. It includes keys and descriptive text not only for the lower forms that are of interest to man as disease inciters or vectors, but also for such higher forms as the poisonous coelenterates, snakes and lizards, arthropods and fish. Part IV covers very completely the field usual to textbooks on the diagnostic methods of the clinical laboratory. The methods described are well chosen and the interpretations are carefully discussed. Chapters on the endocrine glands and on food deficiency diseases are included. An appendix of over 100 pages contains a large amount of purely technical information on culture media, stains, fixatives and methods of bacteria, parasites and tissue, a tabulation of anatomical and physiological normals and an indexed list of the procedures useful in the diagnosis of particular diseases.

If it became necessary that clinical pathologist or clinician be forced to depend upon one simple reference book there seems to be none that would better answer his needs.

The Physician's Business: Practical and Economic Aspects of Medicine. By George D. Wolf, M.D., Attending Otolaryngologist, Sydenham Hospital, New York City; Attending Laryngologist, Riverside Hospital, New York City; Fellow, New York Academy of Medicine; Fellow, American Medical Association, etc. Foreword by Harold Rypins, A.B., M.D., F.A.C.P. 384 pages, illustrated. Philadelphia: J. B. Lippincott Company, 1938. $5.00.

Various matters as the internship, the choice of public or private practice, the location, professional contacts, patients, fees, equipment, office personnel, technics, legal entanglements, insurance, taxes and trends of modern practice are discussed in this volume. A comprehensive exposition of office practice and office routine, with a great many suggestions that the writer has found of practical value, will be of great help in making the practice of medicine easier and more enjoyable. Even the experienced physician will find many ideas that he can use in his own work.

Essentials of Prescription Writing. By Cary Eggleston, M.D., Assistant Professor of Clinical Medicine, Cornell University Medical College, New York City. Sixth Edition, Revised. 155 pages. Philadelphia: W. B. Saunders Company, 1938. Cloth $1.50.

If physicians would glance at a book like this more often, prescriptions would reflect more of the art and skill there is in the practice of medicine. This book has been revised to conform to the eleventh edition of the Pharmacopeia. If any criticism can be given it is in the writing of prescriptions with the amounts in 50 and 100 c. c. Containers of this size will be found only on rare occasions in the ordinary drug store.

Illness: Its Story and Some Common Symptoms, a Guide for the Layman. By S. Henning Belfrage, M.D., London. 173 pages. New York: Oxford University Press, 1938. Cloth $1.50.

A brochure which has for its thesis that the attainment of health is possible through diet, rest, exercise and adjustments to emotional disturbances. There is a discussion of the factors which cause disease and of the more common symptoms which are found in illnesses. It is of no special benefit to the doctor and of doubtful benefit to the layman.

Clinical Methods: A Guide to the Practical Study of Medicine. By Robert Hutchison, M.D., LL.D., F.R.C.P., Consulting Physician to the London Hospital and to the Hospital for Sick Children, Great Ormond Street, and Donald Hunter, M.D., F.R.C.P., Physician (with charge of out-patients) to the London Hospital. Tenth Edition. 658 pages, illustrated. New York: Paul B. Hoeber, Inc. Cloth $4.50.

It is only through long years of experience that the authors have been able to select and condense the large amount of information imparted in this handbook. Clinical, laboratory and physical diagnosis are each briefly described so that the student has a guide to aid him in making his diagnosis. A new plate on asbestosis has been added and the book has been revised. The chapters on the urine and clinical examination of the blood have been completely rewritten. This is an excellent manual.

A Textbook of Hematology. By William Magner, M.C., D.P.H., Pathologist, Saint Michael's Hospital, Toronto, Canada; Lecturer in Pathology, University of Toronto; Formerly Lecturer in Pathology, University College, Cork, Ireland. 395 pages, illustrated. Philadelphia: P. Blakiston's Son & Co., Inc., 1938. Cloth $4.50.

This book has many points which will recommend it to the physician interested in diseases of the blood and blood-forming organs. Emphasis has been given to the study of normal hemopoiesis and the effect of disease and other factors on the hemopoietic organs. Each chapter is well outlined and the subject is presented concisely. The chapter on laboratory methods is especially helpful. The book is illustrated by three color plates, three charts and a number of photomicrographs. The printing is better than the ordinary and the binding is vermin proof and water resisting. It is a book well worth having.

Southern Medical News

ALABAMA

The Goldsby King Memorial Hospital, Selma, has a new addition which provides facilities for twenty patients. Office accommodations for the staff of the Marcus Skinner Clinic will be provided for by the addition of a wing of twenty-nine rooms.

Dr. Kellie N. Joseph, formerly of Decatur, has moved to Birmingham, where his practice is limited to diseases of the chest. Dr. Joseph served for five years on the staff of the Georgia State Tuberculosis Sanatorium at Alto, Georgia, and for the past three years has held the position of state tuberculosis clinician and superintendent and medical director of the Morgan County Tuberculosis Sanatorium at Decatur and of the Tri-Counties Tuberculosis Sanatorium in Scottsboro, Alabama.

Dr. George M. Harms, Chatom, has been appointed Health Officer of Washington County, succeeding Dr. Charles M. Cole, resigned.

Dr. George E. Newton has been named Health Officer of Autauga County with headquarters in Prattville. The similar position he held in Lauderdale County is now held by Dr. Julius E. Dunn with headquarters in Florence. Dr. Dunn was formerly Health Officer of DeKalb County.

Dr. Raymond Robertson Callaway and Miss Sue Clay, both of Birmingham, were married June 9.

Deaths

Dr. B. R. Bradford, Linden, aged 55, died February 21 of bronchopneumonia.

Dr. Joseph H. Cooper, Tuscaloosa, aged 64, died March 16.

Dr. John Howard Foster, Weogufka, aged 54, died February 25 of myocarditis.

Dr. Edgar Gilmore Givhan, Sr., Montevallo, aged 67, died June 3.

Dr. Isaac William Howard, Maysville, aged 68, died March 19 of coronary thrombosis, myocarditis and arteriosclerosis.

Dr. Alfred E. Maumenee, Birmingham, aged 58, died June 5 of a heart attack.

Dr. Solon L. Coleman, Uniontown, aged 64, died recently.

ARKANSAS

Dr. F. O. Mahony, El Dorado, has been elected First Vice-President of the Union County Tuberculosis Association.

Dr. G. R. Siegel has been reappointed Health Officer at Clarksville.

Dr. Raymond T. Smith, Fort Smith, has been elected President-Elect of the Arkansas Hospital Association.

Dr. J. T. Word has moved from St. Charles to Tucker, where he will be physician to the Tucker Penal Farm.

Dr. F. C. McGuire, Jr., has moved from Augusta to the CCC Camp at Jasper.

Dr. R. B. Robins, Camden, has been doing postgraduate work at the University of Michigan.

Dr. O. L. Atkinson has moved from Hickory Ridge to Cotter.

Dr. C. R. Teeter has moved from Pottsville to Russellville, where his son, Dr. Brooks Teeter, will be associated with him in practice.

Dr. Frank A. Norwood, formerly of Little Rock, has located at Mountain Home.

Dr. Ralph E. Weddington, Fort Smith, and Miss Martha Hathcock, Fayetteville, were married May 1.

Dr. Albert S. J. Clarke, Clarendon, and Miss Ruth Shaw Smith, Nashville, Tennessee, were married April 10.

Deaths

Dr. J. F. Evans, Stephens, aged 68, died March 14 of acute myocarditis.

Dr. W. P. Wilson, Ocala, aged 68, died February 25.

Dr. Ernest Lee Hutchison, England, aged 54, died March 3 of angina pectoris.

Dr. Semmie Moberly, Little Rock, aged 42, died February 25 of lobar pneumonia.

Dr. Harvey Doak Wood, Fayetteville, aged 91, died May 13 after a long illness.

DISTRICT OF COLUMBIA

Dr. William P. Herbst, Washington, was elected Chairman of the Section on Urology of the American Medical Association at its recent annual meeting in San Francisco.

At the annual meeting of the Medical Society of the District of Columbia in May Dr. William J. Mallory, Washington, was installed as President. Dr. John Hugh Lyons was elected President-Elect; Dr. William T. Gill, Jr., First Vice-President; Dr. David Davis, Second Vice-President; and Dr. Coursen B. Conklin, Secretary-Treasurer, all of Washington.

Deaths

Dr. Maurice Crowther Hall, Washington, aged 43, died May 1.

FLORIDA

Dr. H. Marshall Taylor, Jacksonville, was elected Chairman of the Section on Laryngology, Otology and Rhinology of the Ameri-

can Medical Association at its recent annual meeting at San Francisco. Dr. Taylor is a Past-President of the Southern Medical Association.

At the recent annual meeting of the Florida Radiological Society in Miami Dr. Harold O. Brown, Tampa, was elected President; Dr. Henry B. McEuen, Jacksonville, Vice-President; and Dr. Joseph H. Lucinian, Miami, Secretary-Treasurer. Meetings are held twice a year, in May and November.

Dr. O. W. Jenkins, Chattahoochee, has resigned his position at the Florida State Hospital and entered private practice at his former home in Georgia.

Joseph Halton Hospital, Sarasota, has a new addition of seventeen rooms.

Dr. J. H. Mills is now located at 910 East Columbus Drive, Tampa.

Dr. M. J. Henderson is doing general practice at Live Oak, with offices in the Stephen Foster Hotel Building.

Dr. C. P. Bullard, Miami, announces the removal of his office to 3924 Northwest Seventh Avenue.

Dr. Charles W. Folsom, Miami, and Mlle. Louise Lacroix, of Paris, France, were married aboard ship in mid-Atlantic on April 20.

Deaths

Dr. James Elbert Adams, Jacksonville, aged 64, died February 28 of myocarditis.

Dr. Calvin Daniel Christ, Orlando, aged 59, died March 19.

Dr. Edward Wray Crockett, Macclenny, aged 47, died February 24.

Dr. Charles H. Field, Bradenton, aged 70, died April 18.

Dr. John Clarence Knight, Plant City, aged 66, died March 6 of coronary thrombosis.

Dr. William Marvin O'Cain, Jasper, aged 65, died February 5 of hypostatic pneumonia, furunculosis and an infected arm.

GEORGIA

At the recent meeting of the Medical Association of Georgia Dr. James LeRoy Campbell, Atlanta, was presented a beautiful silver service "in appreciation of his service to the citizens of Georgia in the prevention and cure of cancer and for his untiring work as Chairman of the Cancer Commission of the Medical Association of Georgia for the past twenty years" by Dr. T. C. Davison, of Atlanta, acting in behalf of the physicians of Georgia. Dr. V. P. Sydenstricker, Augusta, Professor of Medicine at the University of Georgia School of Medicine, won the L. G. Hardman award in recognition of his research on pellagra.

Dr. James E. Paullin, Atlanta, was elected a member of the Board of Regents of the American College of Physicians at their meeting held in New York City, and was reappointed to the Council on Scientific Assembly of the American Medical Association at its recent annual meeting in San Francisco.

Dr. Murdock Equen, Atlanta, was elected a member of the Governing Board of the American Bronchoscopic Society for a term of two years at a recent meeting held in Atlantic City.

Dr. Harold Bowcock, Atlanta, announces the opening of his office in the Doctors Building.

Dr. Alfred A. Weinstein, Atlanta, announces the opening of his offices in the Doctors Building.

Deaths

Dr. Robert Park Adams, Atlanta, aged 60, died March 14 of chronic nephritis and arthritis.

Dr. Lewis Bradley Bibb, Atlanta, aged 56, died March 13 of injuries received in an automobile accident.

Dr. Henry A. Cook, Parrott, aged 75, died February 21 of mitral regurgitation.

Dr. James Robert Dykes, Marshallville, aged 64, died February 20 of heart disease.

Dr. Charles C. Echols, Canon, aged 67, died April 15.

Dr. Thomas D. Fussell, Rhine, aged 57, died April 14.

Dr. Ralston Lattimore, Savannah, aged 67, died April 20.

Dr. John A. Rhodes, Crawfordsville, aged 75, died April 9 of heart disease.

Dr. G. W. Sherrer, Rayle, aged 90, died February 26.

Dr. Manly L. Taylor, Columbus, aged 56, died February 6 of cardiac insufficiency and nephritis.

KENTUCKY

The Fleming County Medical Society has elected Dr. Mirian Bell, Worthville, President; Dr. C. L. Garr, Flemingsboro, Vice-President; and Dr. Roy Orsburn, Greensboro, Secretary.

Letcher County Medical Society has elected Dr. Owen Pigman, Farraday, President; Dr. Aubrey L. Sparks, Jenkins, Vice-President; and Dr. R. Dew Collins, Whitsburg, Secretary.

Woodford County Medical Society, which has been inactive for several years, was revived recently when the physicians of this county met in Versailles. Dr. Charles F. Voigt, Midway, was elected President; and Dr. George H. Gregory, Versailles, Secretary.

The health units of Lexington and Fayette Counties have been consolidated into a single department under the direction of Dr. Charles D. Cawood, who is the present Health Officer. Dr. Charles M. Moore recently resigned as City Health Officer.

Dr. James O. Carson, Bowling Green, who is 82 years old, recently entertained the Warren County Medical Society at a dinner celebrating his completion of sixty years of medical practice.

Dr. John E. Wilson, Falmouth, recently celebrated the completion of fifty years of practice with a dinner attended by physicians and other friends.

Deaths

Dr. Leslie Brand, Maysville, aged 65, died March 22 of injuries received in an automobile accident.

Dr. Deddo H. W. Borgman, Louisville, aged 65, died January 23.

Dr. Jeptha Dickey Davis, Fort Thomas, aged 72, died March 25 of heart disease.

Dr. Richard F. Duncan, Tompkinsville, aged 74, died March 25 of spinal sclerosis.

Dr. Eugene Maurice Griffin, Crider, aged 68, died March 10.

Dr. Andrew Y. Hatchett, Bloomfield, aged 72, died March 23 of pulmonary embolism and diabetes mellitus.

Dr. Thomas Lafayette Higginbotham, Creelsboro, aged 58, died March 4 of cerebral hemorrhage.

Dr. William Alex Quinn, Lakeland, aged 77, died February 27 of pneumonia.

LOUISIANA

Dr. Rudolph Matas, Professor of Surgery at Tulane University School of Medicine, New Orleans, was chosen as first recipient of the distinguished service medal for "meritorious services in the science and art of medicine" created last year by the American Medical Association and which was awarded at the San Francisco meeting of this Association.

At the recent annual meeting of the Louisiana State Medical Society Dr. Joseph A. O'Hara, New Orleans, was installed as President; Dr. Clarence A. Lorio, Baton Rouge, was chosen President-Elect; Dr. Cassius L. Peacock, New Orleans, Dr. Jerome E. Landry, New Orleans, and Dr. Paul D. Abramson, Shreveport, were elected Vice-Presidents; and Dr. Paul T. Talbot, New Orleans, was reelected Secretary. The next annual meeting will be held in Alexandria, April 24, 25 and 26.

Dr. Erwin E. Nelson, New Orleans, was elected Chairman of the Section on Pharmacology of the American Medical Association at its recent annual meeting in San Francisco.

Dr. Guy A. Caldwell, New Orleans, was elected Secretary of the Section on Orthopedic Surgery of the American Medical Association at its recent annual meeting in San Francisco.

Assumption Parish Medical Society has elected Dr. H. C. Dansereau, Labadieville, President; Dr. W. W. Pugh, Napoleonville, Vice-President; and Dr. P. M. Payne, Napoleonville, Secretary-Treasurer.

Dr. Alton Ochsner, New Orleans, gave a series of lectures in Honolulu recently.

The Louisiana State Gynecological and Obstetrical Society recently elected Dr. William D. Phillips, Vice-President, and Dr. H. B. Alsobrook, Secretary-Treasurer, both of New Orleans.

Dr. James T. Nix, New Orleans, had conferred upon him honorary membership by the Loyola Chapter of Theta Beta at its annual banquet.

The Louisiana State Pediatric Society elected Dr. Ruth Aleman, President, and Dr. Philip C. DeVerges, Secretary-Treasurer, both of New Orleans.

Dr. C. Grenes Cole, New Orleans, has been reelected President of the Louisiana State Coroners' Association.

Dr. Francis E. LeJeune, New Orleans, was elected President of the Louisiana-Mississippi Ophthalmological and Otolaryngological Society, held recently.

Deaths

Dr. John Sidney Branch, Lettsworth, aged 78, died March 8 of coronary thrombosis.

Dr. Isidore Brickman, Pineville, aged 36, died May 15.

Continued on page 26

DR. X AND DR. Z DISCUSS

X-ray Intensifying Screens

DOCTOR X—"Well, I agree with you doctor, speed in radiography is essential."

DOCTOR Z—"Yes, I believe that the combination of speed and contrast made possible by the use of X-ray Intensifying Screens is their outstanding advantage."

DOCTOR X—"Certainly nobody can quarrel with that statement. But, personally, I feel that there are other important advantages to the use of intensifying screens."

DOCTOR Z—"There's no doubt about that. I think that the Patterson Screen people hit the nail on the head when they said that 'Intensifying Screens assure BALANCED RADIOGRAPHY'."

X-RAY INTENSIFYING SCREENS ASSURE BALANCED RADIOGRAPHY

1. They greatly reduce exposure time.
2. They greatly reduce danger of movement.
3. They minimize danger of over-exposure to patients.
4. They permit larger number of repeat exposures.
5. They assure a high degree of detail and maximum contrast.
6. They greatly reduce wear and tear on expensive X-ray tubes and equipment.

Patterson X-ray Screens assure Balanced Radiography... plus radiographs of highest possible quality.

THE PATTERSON SCREEN CO., TOWANDA, PA.

Patterson

X-RAY

INTENSIFYING **Screens** FLUOROSCOPIC

PATTERSON . . . THE WORLD'S STANDARD FOR HIGHEST SCREEN QUALITY

Continued from page 826

Dr. John James Gill, Chatham, aged 71, died February 23.

Dr. George Patrick Quinn, Shreveport, aged 35, died February 1.

MARYLAND

Deaths

Dr. John Jacob Abel, Baltimore, aged 81, died May 26.

Dr. Alva Burton Burris, Salisbury, aged 65, died March 25.

Dr. William D. Corse, Baltimore, aged 71, died March 13.

Dr. Mildred Clark Clough, Baltimore, aged 49, died March 11 of bronchopneumonia following osteomyelitis and pyelitis.

Dr. Wade Hampton Frost, Baltimore, aged 58, died May 1 of carcinoma of the esophagus.

MISSISSIPPI

At the recent annual meeting of the Mississippi State Medical Association Dr. Joseph E. Green, Laurel, was installed as President. Other officers are: Vice-Presidents: Northern Division, Dr. Monterville Q. Ewing, Amory; Central Division, Dr. Richard B. Austin, Forest; and Southern Division, Dr. Benjamin T. Robinson, New Augusta; Dr. T. M. Dye, Clarksdale, Secretary, reelected.

The newly elected officers of the Mississippi State Hospital Association are: Dr. H. Lowry Rush, Meridian, President; Dr. Gilruth Darrington, Vicksburg, Vice-President; and Dr. Leon S. Lippincott, Vicksburg, Secretary-Treasurer.

Dr. William Emmett Denman, Jr., Greenwood, and Miss Sal Whitaker, Greenville, were married in February.

Deaths

Dr. Dottery Holden Ward, Bay St. Louis, aged 55, died February 5 of burns received when a gasoline heater in his office exploded.

MISSOURI

St. Louis was selected by the American Medical Association as its 1939 convention city at its recent meeting held in San Francisco.

At the recent annual meeting of the Missouri State Medical Association Dr. B. W. Hays, Jackson, was installed as President. Dr. James R. McVay, Kansas City, was elected President-Elect; Dr. D. C. McCraw, Bolivar, Dr. L. H. Fuson, St. Joseph, and Dr. C. A. W. Zimmermann, Cape Girardeau, Vice-Presidents; and Dr. E. J. Goodwin, St. Louis, Secretary-Editor, reelected.

Dr. Jean V. Cook, St. Louis, was elected Vice-Chairman of the Section on Pediatrics of the American Medical Association at its recent annual meeting in San Francisco.

Dr. Fred M. Bailey, St. Louis, was elected Vice-Chairman of the Section on General and Abdominal Surgery of the American Medical Association at its recent annual meeting in San Francisco.

Dr. Grayson Carroll, St. Louis, was elected Vice-Chairman of the Section on Urology of the American Medical Association at its recent annual meeting in San Francisco.

Dr. E. Lee Miller, Kansas City, was the recipient of a certificate of merit presented by the University of Missouri Alumni Association at a recent luncheon of the Medical Alumni Association of the University of Missouri at Jefferson City.

Dr. Frederick J. Taussig, St. Louis, has been appointed a member of the State Cancer Commission by the Governor to fill the vacancy caused by the death of Dr. Ellis Fischel.

Dr. Frank D. Dickson, Kansas City, was elected President-Elect of the American Orthopedic Association at their recent meeting in Atlantic City.

Dr. Hermon S. Major, Kansas City, announces that Dr. Henry S. Millett is associated with him in the Major Clinic at 3100 Euclid Avenue.

Deaths

Dr. Walter D. Bennie, Naylor, aged 75, died in February of an injury received in a fall several years ago.

Dr. John Franklin Clark, Rayville, aged 82, died March 23.

Dr. Joseph C. R. Doggett, Crane, aged 56, died March 29 of nephritis, arteriosclerosis and hypertension.

Dr. Robert E. Darby, Springfield, aged 73, died March 9 of lobar pneumonia.

Dr. John Azerre Flowers, St. Louis, aged 54, died March 25 of peritonitis.

Continued on page 28

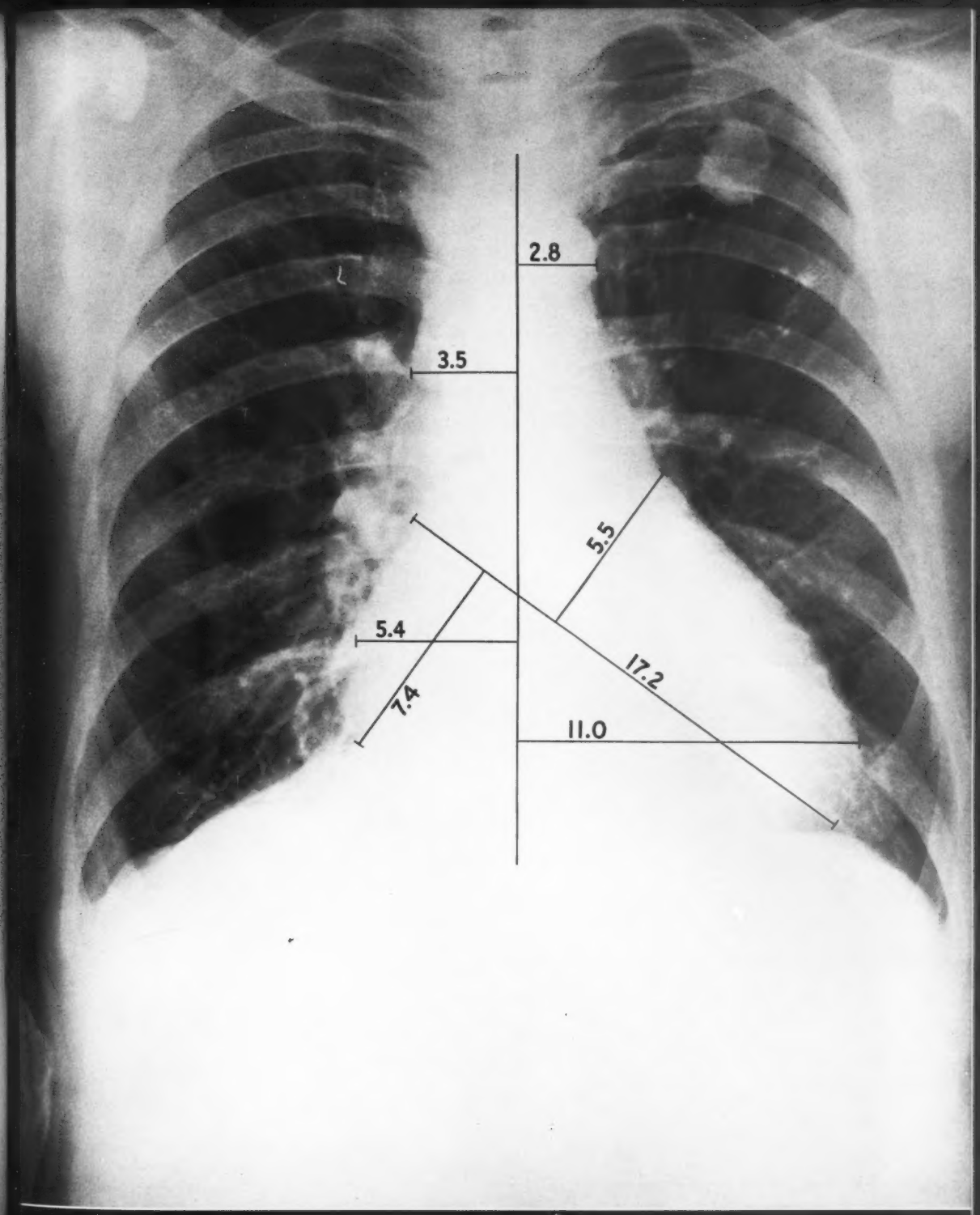
THE NEW YORK POLYCLINIC
MEDICAL SCHOOL AND HOSPITAL
(ORGANIZED 1881)

(The Pioneer Post-Graduate Medical Institution in America)

Proctology, Gastro-Enterology
and ALLIED SUBJECTS

EYE, EAR, NOSE and THROAT

FOR INFORMATION ADDRESS
MEDICAL EXECUTIVE OFFICER: 345 West 50th Street, NEW YORK CITY



Reproduced from a radiograph made on

EASTMAN ULTRA-SPEED SAFETY X-RAY FILM

(See back of this page)

Excerpts from leading Medical Journals

"*In view of . . . uncertainties presented by the history, the physical examination, and the clinical symptoms . . . , especially in the early stages of the disease, it becomes evident that some other method of diagnosis is urgently needed, and it is my belief that the roentgenologic examination is the most satisfactory method of diagnosis of aortitis and of aortic aneurysm—perhaps the only method in early cases.*"—RADIOLOGY, *9:*138, 1927

"*It is apparent that when combined with complete clinical data the roentgen ray is an invaluable aid in cardiac diagnosis.*"—AM. J. ROENTGENOL., *28:*479, 1932

"*The roentgen examination will disclose syphilis of the aorta in from 10 to 30 per cent of the cases in which it is not detected by other means.*"—RADIOLOGY, *23:*214, 1934

The obvious excellence of the original radiograph from which the reproduction printed on the reverse side of this page was made is due, first, to the knowledge of the radiologist; second, to the use of Eastman X-ray Film.

»

REFER YOUR PATIENT TO A COMPETENT RADIOLOGIST

«

EASTMAN KODAK COMPANY

Medical Division—Rochester, N. Y.

(*See reverse side of this page*)

VEGEX
FOR THE B VITAMIN COMPLEX

For the B Complex in Medicine and Nutrition

We specialize in dried brewers' yeast and Vegex, its autolyzed extract. They have stood and stand at the top in vitamin B complex potency—all of the known B vitamins—including B_1, B_2(G) and the growth factor which only the B complex in its entirety can supply. In honor of Dr. Goldberger, vitamin G was designated to mean the P-P (pellagra preventive) factor.

More than fifty million one ounce doses of Vita-Food Dried Brewers' Yeast have gone into the pellagra sections of the South with uniformly satisfactory results in the treatment of pellagra. Vegex has an established medical record for high pellagra preventive potency, in the Southern States, Italy and Egypt.

The Health Departments and the Red Cross have pioneered. Where the Health Department has opened the field we have cooperated, as the Health Departments have requested, to the end that people with pellagra or any other disease be gotten to the physician; and that the physician shall have an available supply, sold, as Dr. Goldberger requested, "at a price the poor can pay," which will leave something in the patient's pocketbook to help pay for the diagnoses and other needed treatment.

VEGEX

Vegex extracts the B vitamins and minerals from the grain grown yeast into more available form. The autolyzing process gives the yeast proteins a tasty meat-like flavor. The Vegex process either concentrates from the yeast or develops the extrinsic factor (anemia). There are now fifty-six reports from medical centers showing the value of Vegex in anemias; particularly in macrocytic and pernicious anemias. Physicians report Vegex a distinct aid to the liver extract treatment. Sturgis, Wills, Vaughan and others used it successfully without liver extract. We have been conservative about this; just pass the facts on to the practitioner.

Vegex was the pioneer product used in the mass treatment of beriberi during the World War; was selected to find the relation of the B vitamins to child growth; the promotion of lactation; in the pioneer studies in gastro-enterology; in disorders relating to diabetes. Being carbohydrate free, it is valuable in carbohydrate restricted diets.

Milk, for example, is low in some of the B vitamins and in iron. Vegex splendidly supplements milk for child feeding. With Vegex children generally drink more milk.

ANOREXIA — STRENGTH AID

In general use, it is now known that the B vitamin complex stimulates appetite, and aids the physician in getting a strength response from the patient. There has been much reported use in post-operative liquid diets.

Samples for clinical or physician's personal use sent on request. No sampling except when requested.

VITAMIN FOOD CO., INC. VEGEX, INCORPORATED
122 Hudson Street, New York, N. Y.

Grace Lutheran Sanatorium For Tuberculosis

A Beauty Spot on Prospect Hill

701 South Zarzamora Street,

San Antonio, Texas

JAMES L. ANDERSON, M.D., Medical Director

Admits patients irrespective of denomination or creed.

Ideal all year climate.—Excellent medical and nursing care.—Radiographic, Fluoroscopic and Pneumothorax service.

New, distinctive, Individual **Bungalows,** highly modern, and **Private Rooms** with baths and sleeping porches, all equipped with radio.—Beautiful grounds.

Moderate rates.

For booklet and information address:

PAUL F. HEIN, D.D.,
Pastor and Superintendent

The Tulane University of Louisiana

SCHOOL OF MEDICINE

The following types of POSTGRADUATE instruction in all branches of medicine are offered to graduate physicians:

(a) Courses leading to advanced degrees.

(b) Fellowship and long courses not leading to advanced degrees.
(Either of the above courses is adaptable towards satisfying certain requirements of the various specialty boards.)

(c) Short intensive courses in special limited fields.

(d) Review courses intended for practicing physicians
(Two six weeks' courses offered each session. The first begins early January and the second mid February.)

(e) Extra-mural teaching through the Extension Division.

For detailed information write (stating type of course wanted) to

Director
Department of Graduate Medical Studies
1430 Tulane Avenue New Orleans, La.

Continued from page 26

Dr. Ellis Fischel, St. Louis, aged 55, was killed May 14 in an automobile accident.

Dr. Harold Bertram Hedrick, Kansas City, aged 47, died February 21 of cerebral hemorrhage.

Dr. Joseph P. Hennerich, St. Louis, aged 78, died March 30 of coronary occlusion.

Dr. William Garfield Henderson, Cuba, aged 57, died April 19 of coronary thrombosis.

Dr. Joseph W. Mills, Owensville, aged 56, died March 1 following an operation.

Dr. Merton Carl Moss, St. Louis, aged 41, died March 20 of pneumonia.

Dr. Daniel Morton, St. Joseph, aged 73, died March 14 of septicemia.

Dr. Charles Andrew Moore, Springfield, aged 72, died March 7.

Dr. John Donaldson Porterfield, Jr., Cape Girardeau, aged 61, died March 10 of cerebral hemorrhage.

Dr. Willard Curtis Proud, St. Joseph, aged 65, died April 29.

Dr. Horace A. Reddish, St. Louis, aged 51, died February 5 of hypertensive heart disease.

NORTH CAROLINA

At the annual meeting of the Medical Society of the State of North Carolina held recently Dr. James Buren Sidbury, Wilmington, was installed as President. Dr. William Allan, Charlotte, was elected President-Elect; Dr. Claude B. Williams, Elizabeth City, and Dr. Millard D. Hill, Raleigh, Vice-Presidents; and Dr. Thomas W. M. Long, Roanoke Rapids, Secretary, reelected.

Dr. Oscar L. Miller, Charlotte, was elected Chairman of the Section on Orthopedic Surgery of the American Medical Association at its recent meeting in San Francisco.

The North Carolina Public Health Association has elected Dr. Joseph A. Morris, Oxford, President; Dr. Avon H. Elliott, Wilmington, Vice-President; and Dr. John William Roy Norton, Raleigh, Secretary-Treasurer.

The Southeastern Dermatological Association will hold its fourth annual meeting in Charlotte the first week-end in September. Dr. J. Lee Kirby-Smith, Jacksonville, Florida, is Chairman, and Dr. Joseph Alexander Elliott, Charlotte, Secretary.

The Virginia Section of the American College of Physicians, held in Charlottesville recently, elected Dr. J. W. Preston, Roanoke, President, and Dr. George B. Lawson, Roanoke, Secretary, reelected.

Dr. John McCampbell, Superintendent of Western State Hospital, Morganton, resigned, effective June 1.

Dr. Thomas W. Baker has opened offices at 119 West Seventh Street, Charlotte, for the practice of Internal Medicine and Neurology.

Dr. Edith Goodwin and Mr. Jesse O. Barbour, both of Morganton, were married in April.

Dr. Hugh Alexander McAllister, Lumberton, and Miss Helen Louise Rinde, Washington, were married April 22.

Dr. Robt. H. Lafferty and Dr. Clyde C. Phillips announce the association with them of Dr. O. D. Baxter in the practice of x-ray diagnosis, x-ray and radium therapy.

DEATHS

Dr. Lester L. Anderson, Stoneville, aged 35, died April 18.

Dr. George A. Brown, Banner Elk, aged 68, died March 28 of acute dilatation of the heart, hypertension and nephritis.

Dr. Logan Elmore Farthing, Wilmington, aged 58, died March 31.

Dr. Joseph Harry Honnet, Wilmington, aged 63, died February 28 of coronary thrombosis.

Dr. James Max Keaton, Asheville, aged 59, died February 22 of acute dilatation of the heart.

Dr. John Daniel Kerr, Clinton, aged 53, died March 16 of injuries received in an automobile accident.

Dr. H. B. Shields, Carthage, aged 85, died April 16.

Dr. Albert R. Wilson, Greensboro, aged 78, died April 22.

Dr. Henry Bascom Weaver, Asheville, aged 86, died February 13 of nephritis.

OKLAHOMA

At the recent annual meeting of the Oklahoma State Medical Association Dr. H. K. Speed, Sr., Sayre, was installed as President;

Continued on page 30

Now

Available

in **TABLET FORM**

SMAco NICOTINIC ACID

(3:Pyridine Carboxylic Acid)

While making no therapeutic claims, we offer the following references to the literature for the attention of the physician.

REFERENCES

1. "Treatment of Human Pellagra with Nicotinic Acid"—Fouts, Helmer, Lepkovsky and Jukes; Proc. Soc. Exp. Biol. & Med.; 37:405: (Nov.) 1937.
2. "Relation of Nicotinic Acid and Nicotinic Acid Amide to 'Canine Blacktongue' "—Elvehjem, Madden, Strong and Wooley; Jrl. Amer. Chem. Soc. 59:1767: (Sept.) 1937.
3. "Therapeutic Administration of Nicotinic Acid, in Human Beings During Health and Disease,"—Spies, Cooper and Blankenhorn. (Read before the Central Society for Clinical Research, Chicago—Nov. 1937—To be published).
4. "Nicotinic Acid and the Pellagra Preventing ('P-P') Vitamin"—Harris; Chem. & Ind.; 56:1134: (Dec.) 1937.
5. "Pellagra Successfully Treated with Nicotinic Acid—A Case Report."—Smith, D. T., M.D.; Ruffin, Julian M., M.D.; and Smith; Susan Cower, M.A.; Jrl. A.M.A. 109:2054: (Dec. 18) 1937.
6. "Nicotinic Acid and Vitamin B_2" — Dann, W. J.; Science; 86:616: (Dec. 31) 1937.
7. "Pellagra and Nicotinic Acid" An Editorial — Jrl. A.M.A. 110-289 (Jan. 22) 1938.
8. "Relation of Nicotinic Acid to Human Pellagra," an editorial, Jrl. A.M.A., 109:1203:1937 (Oct. 9).
9. "The Use of Nicotinic Acid in the Treatment of Pellagra,"—Spies, Cooper and Blankenhorn; Jrl. A.M.A. 110:622:1938 (Feb. 26).
10. "Advances in the Treatment of Pellagra."—Editorial, Annals of Internal Medicine 11:1760 (March) 1938.
11. "A Note on the Relationship of Porphyrinuria to Human Pellagra." Tom Douglas Spies, M.D., Yasuo Sasaki, Ph.D., and Esther Gross, M.S., Southern Medical Journal, Vol. 31, No. 5, May, 1938. Page 483.

Physicians may now obtain SMAco Nicotinic Acid (3:Pyridine Carboxylic Acid) for Clinical experimentation in tablet form for oral administration. Two potencies are available: 100 milligrams per tablet, or 20 milligrams per tablet.

SMAco Nicotinic Acid (3: Pyridine Carboxylic Acid) Tablets, of both potencies, are scored permitting a wide flexibility in dosage. Tablets may be broken in two parts at the score, enabling the physician to administer any multiple of 10 milligrams as a dose.

SMAco Nicotinic Acid (3:Pyridine Carboxylic Acid) is available in tablet form in the following packages:

	LIST NO.
100-Milligram tablets, bottles of 20	**7331**
100-Milligram tablets, bottles of 200	**7333**
20-Milligram tablets, bottles of 50	**7311**
20 Milligram tablets, bottles of 500	**7315**

You may have your pharmacist order any of the above packages in the regular way, or you may order Clinical Trial Packages as follows direct from us at professional discount. Address Department 12-78.

	RETAIL
100-Mg. tablets, bottle of 20 (SMAco 7331)	**$1.50**
20-Mg. tablets, bottle of 50 (SMAco 7311)	**$1.50**

S. M. A. CORPORATION · CLEVELAND, OHIO

Makers of Fine Nutritional Specialties

PRODUCERS OF: SMAco Nicotinic Acid (3:Pyridine Carboxylic Acid) SMAco Carotene-in-oil SMAco Carotene-with-Vitamin-D-concentrate-in-oil Alerdex Hypo-Allergic Milk Protein S.M.A. (Acidulated) S. M. A.

COMPLETE X-RAY COURSE

A recently installed complete Westinghouse X-Ray Equipment, additional teaching personnel, revision of curriculum enable us to offer a THREE MONTHS' Course in X-Ray Technique.

Send your Technician to brush up on latest X-Ray Methods.

LABORATORY COURSE IN CLINICAL PATHOLOGY OF NINE MONTHS

Modern equipment, competent teaching personnel, under an experienced Director.

Write for Catalog.

Subscribe for Gradwohl Laboratory Digest: a monthly digest of the latest laboratory advances.

Gradwohl School of Laboratory Technique

3514 Lucas Avenue, St. Louis, Mo.
R. B. H. Gradwohl, M.D., Director.

Continued from page 28

Dr. W. A. Howard, Chelsea, was chosen President-Elect; and Dr. L. S. Willour, McAlester, Secretary, reelected.

The following promotions were approved, among others, at a meeting of the Board of Regents of the University of Oklahoma, Oklahoma City, in April: Dr. James Patton McGee, Assistant Professor of Ophthalmology, to Associate Professor of Ophthalmology; Dr. Joseph C. MacDonald, Assistant Professor of Otorhinolaryngology, to Associate Professor of Otorhinolaryngology; Dr. Joseph W. Kelso, Assistant Professor of Gynecology, to Associate Professor of Gynecology.

Deaths

Dr. William Alfred Buice, Chelsea, aged 47, died February 3 of coronary thrombosis.

Dr. Humberto Cuen, Claremore, aged 28, died March 28 of heart disease.

Dr. Wilson Luther Gleason, Fairview, aged 79, died March 28 of cerebral hemorrhage.

Dr. Tolbert Berton Hinson, Enid, aged 56, died March 21 of pulmonary embolus following fracture of the hip.

Dr. Charles Perry Horner, Enid, aged 64, died February 6 of cerebral hemorrhage.

Dr. William Irving Joss, Erick, aged 67, died February 21 of cerebral hemorrhage.

Dr. John P. Sudderth, Nowata, aged 69, died February 15 of cirrhosis of the liver.

Dr. Henry Franklin Zink, Tulsa, aged 70, died February 21.

SOUTH CAROLINA

At the recent annual meeting of the South Carolina Medical Association Dr. James R. DesPortes, Fort Mill, was installed as President. Dr. Douglas Jennings, Bennettsville, President-Elect; Dr. George E. Thompson, Spartanburg, was elected Vice-President; and Dr. E. A. Hines, Seneca, Secretary-Treasurer, reelected.

At the annual meeting of the South Carolina X-Ray Society all officers were reelected to succeed themselves: Dr. Percy Hay,

Continued on page 32

do you treat CANCER?

THE RADIUM EMANATION CORPORATION

MAINTAINS the most efficiently organized Radium laboratory to make available to you, at low cost, every facility for the use of Radium in your practice.

RADON SEEDS. Removable or permanent. We provide seeds of the composite type, with Radon under leak-proof glass seal. Filtration 0.3 mm. of Platinum.

APPLICATORS. Uterine tubes, cervical applicators, surface plaques properly prepared to meet the requirements of each individual case.

OUR SERVICE is available to you day and night including Sundays and holidays. Your inquiries and orders will receive our prompt and careful attention.

THE RADIUM EMANATION CORP.

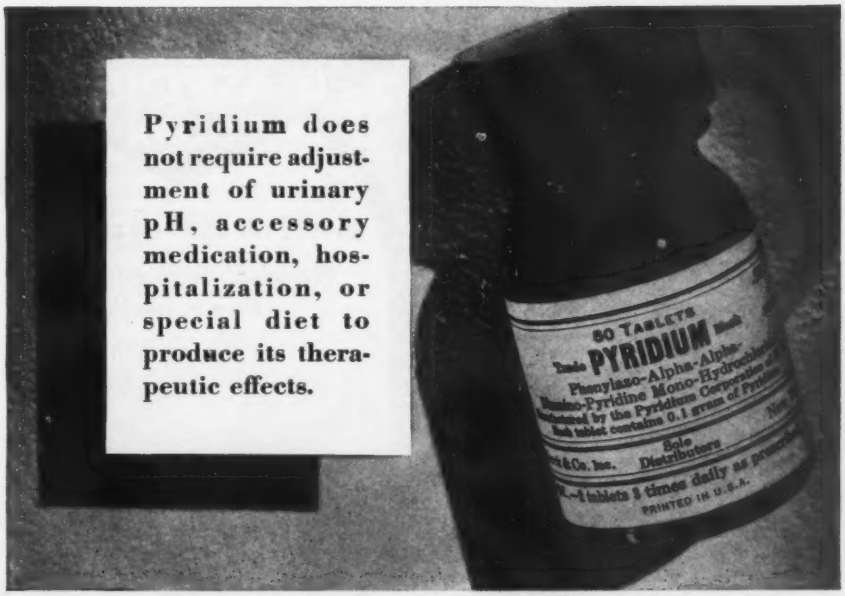
GRAYBAR BLDG. **Tel.: MO hawk 4-6455** **NEW YORK, N. Y.**

PYRIDIUM

For prompt and safe

amelioration of distressing symptoms

during Urogenital Infections


Pyridium does not require adjustment of urinary pH, accessory medication, hospitalization, or special diet to produce its therapeutic effects.
60 TABLETS
PYRIDIUM
Phenylazo-Alpha-Alpha-Diamino-Pyridine Mono-Hydrochloride
Sole Distributors
PRINTED IN U.S.A.

Literature on Request

MERCK & CO. Inc. *Manufacturing Chemists* **RAHWAY, N. J.**

The Surgeon—
The Anesthetist—
The Hospital Management—

Will be pleased with the high purity of "PURITAN MAID" CYCLOPROPANE, the excellent results obtained from its use, and the economies effected in the cost of anesthesia.

A SAFETY FEATURE—

While Cyclopropane itself is a low-pressure gas, it is used often on gas machines opposite high-pressure gas cylinders. To eliminate the possibility of explosions due to the passing of high-pressure gases into the Cyclopropane cylinder, "PURITAN MAID" Cyclopropane is supplied to our customers in steel cylinders complying with the same I. C. C. specifications that apply to high-pressure gases.

Write us for reprints of interesting articles on the subject of CYCLOPROPANE anesthesia, Oxygen Therapy, and other matters pertaining to the use of gases.

PURITAN COMPRESSED GAS CORP.
General Offices, Kansas City, Mo.
Branches in Most Principal Cities

Cyclopropane
Nitrous Oxid
Ethylene

Oxygen
Carbon Dioxid
Helium

Percentage Mixtures of Carbon Dioxid and Oxygen; Also Helium and Oxygen

Manufacturers and Distributors—Oxygen Tents, Nasal Catheter Units, Bedside Inhaling Outfits, Anesthetic Gas Machines, Resuscitators and Inhalators, Soda Lime.

Classified Advertisements

EXCEPTIONAL OPPORTUNITY FOR EYE SPECIALIST IN BIRMINGHAM. Complete equipment, including Bausch and Lomb slit lamp, rotoscope, new perimeter, ophthalmoscope with electric attachment, giant magnet and a large assortment of auxiliary instruments needed in the practice of ophthalmology and otolaryngology. This, together with offices and practice of a recently deceased specialist in diseases of the eye, ear, nose and throat, may be had very reasonably. Receipts of this practice totaled over $17,000 during 1937. Patients are inquiring daily as to whom will be the successor in this established office. For details write Mrs. Alfred E. Maumenee, 2930 Berwich Road, Birmingham, Alabama.

FOR SALE—Oxford Loose Leaf Medicine by Christian. Up to the minute, new condition. Make reasonable offer. Dr. Ira J. Sellers, 502 Lincoln Life Building, Birmingham, Alabama.

ASSISTANCE OFFERED TO MEDICAL WRITERS. Research Abstracts. Translations (all languages). Papers prepared from author's data. Ten years' experience with leading physicians and appointments on medical journals of highest standing. I employ no assistants; all my work is done personally and is reliable. Florence Annan Carpenter, 1801 Sixteenth St., N. W., Washington, D. C.

X-RAY AND LABORATORY TECHNICIAN who almost doubled the amount of work over her predecessors where she is now employed desires position in the South. Radiographs praised by noted roentgenologist. Best of references. Write Dept. 18, care JOURNAL.

Continued on page 34

Florence, President; and Dr. Hillyer Rudisill, Charleston, Secretary and Treasurer.

At the recent annual meeting of the State Association Dr. Edgar A. Hines, Seneca, Secretary and Editor-in-Chief of the *Journal of the South Carolina Medical Association*, was presented a silver tray, pitcher and tumblers as a token of appreciation for his faithful and untiring service of more than thirty years.

The Fifth District Medical Society has elected Dr. James A. Buchanan, Jr., Winnsboro, President; Dr. R. E. Abell, Chester, Vice-President; and Dr. C. S. McCants, Winnsboro, Secretary.

Dr. Roger Doughty, Columbia, has been elected to the temporary Board of Directors of South Carolina Hospital Savings Association to fill the vacancy created by the resignation of Dr. T. A. Pitts.

Dr. William Hayne Folk, Spartanburg, and Miss Alice Ruth Reeves, Union, were married in February.

DEATHS

Dr. Louis D. Barbot, Charleston, aged 70, died March 24 of paralytic ileus and coronary sclerosis.

Dr. Ezra McKnight Davis, Mayesville, aged 54, died March 11.

Dr. John William Folk, Newberry, aged 86, died February 3.

Dr. Clarence H. S. Henderson, Greenwood, aged 61, died March 11 of heart disease and pulmonary abscess.

Dr. William Francis Holmes, Florence, aged 69, died March 9 of influenza and pneumonia.

Dr. William D. Hutto, Greenwood, aged 79, died February 25.

Dr. George Franklin Roberts, Lexington, aged 55, died January 22.

TENNESSEE

Dr. Edward Clay Mitchell, Memphis, was elected Chairman of the Section on Pediatrics of the American Medical Association at its recent annual meeting in San Francisco.

Dr. Harrison H. Shoulders, Nashville, was elected Speaker of

Continued from page 30

DIASPORAL
DOAK

Sulfur-Diasporal

"Original Colloidal Sulfur Preparation"

CHRONIC ARTHRITIS, MYOSITIS, SCIATICA

Intravenous:
2 cc. ampuls 10 mgm.S.
5 cc. ampuls 30 mgm.S.

Intragluteal:
2 cc. ampuls. 25 mgm.S.

Please request reprints from medical journals

DOAK
COMPANY, INC.
CLEVELAND, OHIO.

Modern Treatment of Malaria

● Nowadays in the treatment of malaria it is possible to secure relief from the symptoms promptly, sterilization of the blood in a remarkably short period, and a relapse rate much lower than that seen formerly.

This can be accomplished with Atabrine, which is usually well tolerated by patients of all ages, during pregnancy and in blackwater fever.

A résumé of outstanding reports, culled from a comprehensive literature now comprising about 1200 papers, will be sent upon request.

HOW SUPPLIED: Tablets of 0.1 Gm. (1½ grains), in tubes of 15 and bottles of 25, 100 and 500; tablets of 0.05 Gm. (¾ grain) in bottles of 50 and 500. Also sugar coated tablets of 0.1 Gm. (1½ grains), in bottles of 25.

For cerebral and pernicious types of malaria, ampules containing 0.2 Gm. of sterile powder and 10 cc. sterile distilled water (for intramuscular or intravenous injection), in boxes of 5 ampules each.

Radical Reduction of Prices Recently Announced

WINTHROP

ATABRINE

Reg. U. S. Pat. Off. & Canada

Brand of CHINACRIN

Methoxychlordiethyl aminopentylamino-acridine

Manufactured and standardized in the laboratories of the Winthrop Chemical Company, Inc., Rensselaer, N. Y.

WINTHROP CHEMICAL COMPANY, INC.

Pharmaceuticals of merit for the physician

NEW YORK, N. Y. WINDSOR, ONT.

Factories: Rensselaer, N. Y. - Windsor, Ont.

598M

"Mesco" Ointments

Ophthalmic Ointments a specialty for thirty-seven years. "MESCO" Ointments include the most complete line of Ophthalmic & Nasal Ointments. Specify "MESCO" when ordering. We encourage your request for samples.

Manhattan Eye Salve Co.
Louisville, Ky.

SCABIES TREATMENT

Clinically Established*

NON-IRRITATING
PLEASANT ODOR
RAPIDLY EFFECTIVE

If you would like to give it a test, send 20c to cover handling and we will mail enough for one adult treatment.

**Report on 1213 cases on request*

UPSHER SMITH CO.
MINNEAPOLIS, MINN.
PRODUCERS OF
FINE DIGITALIS PRODUCTS

"Patients Do Not Tire of the Delicious Flavor"—

HORLICK'S *The Original* MALTED MILK

It is remarkable the many cases which are reported, where patients have been confined, even when exclusively, to a diet of Horlick's, and yet they continue to relish and enjoy its delicious flavor. And it is so easy to prepare—just add to water and mix quickly with egg beater, or other handy mixer.

On account of its low curd-tension, Horlick's is frequently more acceptable to the individual—more easy to digest.

Horlick's Malted Milk Tablets, natural and chocolate flavors, contain the same remarkably nourishing and digestible qualities as the powder form, and offer a pleasing and unusual variant to the liquid diet.

Samples and literature sent upon request on your physicians' prescription blank

Horlick's Malted Milk Corp.
Racine, Wis.

Continued from page 32

the House of Delegates of the American Medical Association at their recent meeting held in San Francisco.

At the recent annual meeting of the Tennessee State Medical Association Dr. Tom R. Barry, Knoxville, was elected President; Dr. John Jackson, Dyer, Vice-President for West Tennessee; Dr. W. S. Rude, Ridgetop, Vice-President for Middle Tennessee; Dr W. A. Garrott, Cleveland, Vice-President for East Tennessee; Dr. H. H. Shoulders, Nashville, Secretary-Editor; and Dr. W. M. Hardy, Assistant Secretary-Editor.

The Tennessee State Pediatric Society has elected Dr. William Van Order, Chattanooga, President; Dr. J. C. Overall, Nashville, Vice-President; and Dr. Kinsey M. Buck, Memphis, Secretary.

The Tennessee Academy of Ophthalmology and Otolaryngology has elected Dr. J. B. Stanford, Memphis, President; Dr. G. W. Burchfield, Maryville, Vice-President; and Dr. W. D. Stinson, Memphis, Secretary-Treasurer.

Dr. Kendall B. Corbin, of Stanford University, California, has been appointed Associate Professor of Anatomy and Histology at the University of Tennessee School of Medicine, Memphis.

Dr. William J. Murphy, Kingsport, has been appointed to the staff of the State Department of Health for work in venereal disease control.

A tumor clinic to be established at Meharry Medical College, Nashville, will have Dr. Heddy S. Shoulders, Professor of Roentgenology at the College, as Director, and Dr. John H. Hale as Associate Director. A committee of the faculty responsible for working out methods and policies includes: Dr. John J. Mullowney, President of the College; Dr. Edward L. Turner, Dr. William S. Quinland, Dr. Garland N. Adamson, and Dr. Robert J. Warner.

Dr. Jack Thompson Farrar, Tullahoma, and Miss Grace Elizabeth McKee, Faunsdale, Alabama, were married May 1.

Dr. Harry H. Jenkins and Miss Varina Mayo, both of Knoxville, were married February 19.

Deaths

Dr. William Lowry Arnold, Church Hill, aged 63, died March 11 of cerebral hemorrhage.

Dr. Clarence Frederick Bass, Chattanooga, aged 52, died March 3 of cardiac insufficiency and thrombosis.

Dr. E. B. Dickson, Coal Creek, aged 83, died April 11.

Dr. Edward Sims Hawkins, Cedar Hill, aged 88, died January 15.

Dr. Albert LaFayette Johnson, Knoxville, aged 68, died March 29.

Dr. William Matthew Raymond, Pickwick Dam, aged 31, died March 30.

Dr. John A. Ferguson, Memphis, aged 75, died March 14.

Dr. Selig Clifton Frost, Memphis, aged 60, died March 11 of carcinoma of the larynx.

TEXAS

Dr. Holman Taylor, Secretary of the Texas State Medical Association, Fort Worth, was guest of honor at a testimonial banquet April 8, the occasion marking his retirement as Brigadier General commanding the Sixty-First Field Artillery of the National Guard.

Dr. Bedford Shelmire, Dallas, was elected Chairman of the Section on Dermatology of the American Medical Association at its recent annual meeting in San Francisco.

Dr. C. F. Lehmann, San Antonio, was elected Secretary of the Section on Dermatology of the American Medical Association at its recent annual meeting at San Francisco.

The new U. S. Army Hospital at Fort Sam Houston, for the Eighth Corps Area, was opened in February. The building is of Spanish design, seven stories, and has a capacity of 418 beds.

Dr. William N. Powell is Chairman of the City Health Commission of Temple, succeeding Dr. Arthur C. Scott, Jr. Dr. Scott resigned to become a Director of the Brazos River Conservation and Reclamation District.

Dr. F. A. Snidow, formerly of Iowa City, Iowa, has moved to El Paso, where he will be associated with the El Paso Medical and Surgical Clinic, practice limited to obstetrics and gynecology.

Deaths

Dr. Ben Neal Ard, Dallas, aged 53, died March 29 of carcinoma of the esophagus.

Dr. James Robert Floyd, Fort Worth, aged 77, died March 31 of pneumonia.

Dr. John Pinkham Rice, San Antonio, aged 84, died February 23 of senility.

Dr. Harry Raymond Thomas, Dallas, aged 59, died in February of coronary thrombosis.

Continued on page 36

In MALE SEX HORMONE DEFICIENCIES

ORETON

(Testosterone Propionate)

BENIGN PROSTATIC HYPERTROPHY—Patients experience definite relief from symptoms associated with urinary difficulties and retention, striking amelioration of the emotional and mental state.

AGING MEN—*Oreton* has shown a definite tonic action in bringing about a sense of increased well-being and renewed vigor. Vasomotor and mental symptoms, such as nervousness, headaches, excitability, fatigability, and melancholia generally disappeared. The same results were observed in surgical castrates suffering from these disturbances.

IMPOTENCE—Impotence in older as well as younger individuals frequently responds well to *Oreton*.

HYPOGONADISM—*Oreton* has produced striking objective as well as subjective results even in individuals well beyond the age of puberty. Increase in size of genitalia, growth of pubic and axillary hair, and increase in the number and power of erections have been noted.

ORETON* is crystalline testosterone propionate in a solution of sesame oil. It is available in 1 cc. ampules containing 5, 10, and 25 mgm. per cc.

Dosage—In average cases the dosage is 10 mgm. given daily at first—later 3 times per week. In many cases of impotence and hypogonadism, the 25 mgm. gram concentration is required. For tonic action and maintenance dosage, the 5 mgm. strength is available.

FOR ADDITIONAL INFORMATION, PLEASE
ADDRESS THE MEDICAL RESEARCH DIVISION

*Reg. U. S. Pat. Off. Copyright 1938, Schering Corporation

SCHERING CORPORATION

BLOOMFIELD, NEW JERSEY

Continued from page 34

VIRGINIA

Dr. I. C. Riggin, Richmond, was elected Chairman of the Section on Preventive Medicine of the American Medical Association at its recent annual meeting in San Francisco.

Dr. Robert V. Funston, Charlottesville, was elected Vice-Chairman of the Section on Orthopedic Surgery of the American Medical Association at its recent annual meeting in San Francisco.

Alleghany-Bath Medical Society has elected Dr. Robert A. Warren, Hot Springs, President; Dr. Louis A. Houff, Clifton Forge, Vice-President; and Dr. Robert P. Hawkins, Clifton Forge, Secretary-Treasurer, reelected.

Amelia County Medical Society, a unit of the Fourth District Medical Society, has elected Dr. H. Cowles Rucker, Mattoax, President; Dr. J. M. Habel, Jetersville, Vice-President; and Dr. J. L. Hamner, Mannboro, Secretary-Treasurer, reelected.

Roanoke Academy of Medicine has elected officers for the year beginning October as follows: Dr. L. G. Richards, President; Dr. Charles A. Young, Vice-President; and Dr. A. C. Davis, Secretary-Treasurer, all of Roanoke.

South Piedmont Medical Society has elected Dr. Coleman D. Bennett, Chatham, President.

The Virginia Pediatric Society held its annual clinical meeting in May at Old Point Comfort with Dr. W. A. McGee, Richmond, President, presiding. Dr. J. M. Bishop, Roanoke, is Secretary. The next meeting will be held in Danville at the time of the State Society meeting in October.

The Medical College of Virginia has organized the following new Alumni Chapters: Petersburg Alumni, Dr. Mead Edmunds, President; Lynchburg Alumni, Dr. James R. Gorman, President; Roanoke Alumni, Dr. John O. Boyd, President.

The Mental Hygiene Society of Virginia, at its recent annual meeting, elected Dr. Howard Masters, Richmond, President.

The American Association of Bacteriologists and Pathologists has accepted the invitation of the Medical College of Virginia to hold its next annual meeting in Richmond. The date will probably be April 6 and 7, 1939.

The new $313,000 dormitory of the Medical College of Virginia is ready for occupancy. It is designed to house 147 occupants (residents, interns and others of the hospital division and

Continued on page 38

BUFFERED ALKALINIZATION
by the safe, physiological process

WHERE buffered alkalinization is desirable—as during sulfanilamide administration, in the treatment of colds, influenza and other seasonal respiratory affections—Kalak offers these clinical advantages:

(1) It presents a balanced combination of bicarbonates in solution. (2) It contains the mineral substances normal to the blood (and no other).

Kalak's high buffering value helps to maintain the urinary pH of 7.4 which has been found so desirable in sulfanilamide therapy.

KALAK
is synthetically prepared—is hypertonic, uniform in composition, definite in alkali potency.

KALAK WATER COMPANY OF NEW YORK, INC., 6 CHURCH STREET, NEW YORK CITY

To Assure Quick Dependable Response
Discriminating Physicians are Prescribing
the easily soluble

ACCEPTED AMERICAN MEDICAL ASSN.

DUBIN AMINOPHYLLIN
THEOPHYLLINE-ETHYLENEDIAMINE

American Made from American Materials

H.E.DUBIN LABORATORIES
INCORPORATED
250 E. 43rd St. New York, N.Y.

During Summer Months

METABOLISM TAKES NO HOLIDAY

Although appetites grow listless under the oppressive heat of summer and the wise eat lightly, the nutritive requirements of the body get no vacation.

Adequate vitamins and minerals — so often deficient in the average American diet — continue indispensable for optimum health and vigor.

VI-SYNERAL

The Original Vitamin-Mineral Concentrate
Prepared under the Direction of
Dr. Casimir Funk and Dr. H. E. Dubin

supplies all the definitely recognized vitamins together with eight essential minerals, in Funk-Dubin balanced potencies for each age group.

Particularly for infants and children, for expectant and nursing mothers, for convalescents, and in restricted and reducing diets, it provides an invaluable "vitamin-mineral diet insurance."

Write for recent protocols on advances in vitamin-mineral therapy.

U. S. VITAMIN CORPORATION

250 East 43rd St. **New York, N. Y.**

Continued from page 36

the senior medical class) with cafeteria, auditorium, reading room and other ultra modern facilities.

Dr. R. G. Beachley has assumed his duties as Health Officer in Arlington County, succeeding Dr. Earl G. Brown, who resigned to accept a position in New York State. Dr. Beachley was formerly Deputy Director of Rural Health in the Southwest Health District.

The Governor has reappointed the following as members of the Medical Examining Board of Virginia for a term of four years: Dr. R. D. Bates, Newton; Dr. P. St. L. Moncure, Norfolk; Dr. H. U. Stephenson, Toano and Richmond; Dr. I. C. Harrison, Danville; Dr. J. W. Preston, Roanoke; Dr. P. W. Boyd, Winchester; Dr. Lewis Holladay, Orange; and Dr. F. H. Smith, Abingdon.

At the annual meeting of the Virginia Academy of Science, held recently, Colonel Earle B. Norris, Dean of Engineering at the Institute, was elected President, and Dr. E. C. Miller, Richmond, reelected Secretary-Treasurer.

Appointed to the State Advisory Board on Mental Hygiene are: Dr. J. S. DeJarnett, Staunton; Dr. Joseph Blalock, Marion; Dr. O. B. Darden, Richmond. Members reappointed are: Dr. Hugh Henry, Petersburg; Dr. George Brown, Williamsburg; and Dr. Harvey DeJ. Coghill, Dr. Finley Gayle, Dr. Howard Masters, and Dr. James Asa Shield, all of Richmond.

A new Eye, Ear, Nose and Throat Hospital has been opened at Norton by Dr. George W. Botts. It has thirty six rooms with twenty-one beds and is modern in every respect.

Dr. Joseph A. White, Richmond, celebrated his ninetieth birthday in April. He is the oldest living member of the Medical Society of Virginia in point of continuous membership, having joined in 1880.

Dr. George Winslow Simpson, Norfolk, and Miss Virginia Frances Martin, South Norfolk, were married April 7.

Dr. John Keller Owen, Charlottesville, and Miss Frances Marshall Baker, Alexandria, were married May 7.

Dr. William Bernard Carpenter, Lovettsville, and Miss Eilene Ward, Richmond, were married April 6.

Dr. Joseph Edward Gladstone, Exmore, and Miss Doretta Anne Roberts, Cape Charles, were married April 9.

Deaths

Dr. Millard Henry Crawford, Charlottesville, aged 85, died March 20 of cardiac embolus.

Dr. Lazarus Karp, Richmond, aged 51, died May 23.

Dr. Samuel Thomas Anderson Kent, Ingram, aged 53, died May 23.

Dr. St. Julien Oppenheimer, Richmond, aged 72, died May 1.

Dr. Richard Washington, Claymont, aged 75, died February 3 of heart disease.

Dr. Joseph Wolfe, Coeburn, aged 67, died April 7.

Dr. Fletcher Johnston Wright, Petersburg, aged 65, died May 8.

WEST VIRGINIA

Postgraduate courses under the direction and auspices of the State Association will begin Monday, July 18. Two circuits will be operated, one for the northern part and one for the southern part of the State. The centers on the northern circuit will be Martinsburg, Keyser, New Martinsville, Weston and Fairmont, and the lecturers will be Dr. L. H. Douglas, Professor of Obstetrics, University of Maryland, Baltimore; and Dr. T. Campbell Goodwin, Chief of the Division of Pediatrics, Baltimore City Hospital. The centers on the southern circuit will be Fayette County, Logan, Welch, Beckley and Ronceverte, and the lecturers will be Dr. William F. Mengert, Professor of Obstetrics, University of Iowa, and Dr. Lee Palmer, Louisville, Kentucky.

Deaths

Dr. Leonard J. Bernstein, Wellsburg, aged 48, died May 4.

Dr. John Henry Chapman, Tanner, aged 71, died February 20.

Dr. Cecil Denham, Buckhannon, aged 64, died March 4.

Dr. Curtis L. Lyon, Charleston, aged 64, died March 20 of carcinoma of the sigmoid with perforation and peritonitis.

Dr. J. Sumner Stone, Wheeling, aged 82, died February 18 of acute dilatation of the heart.

Dr. Francis Errett Roberts, Moundsville, aged 47, died February 6 of pulmonary and intestinal tuberculosis.

Dr. Mack Henry Tabor, Crumpler, aged 52, died May 16.

Pancreas Therapy
BY
Oral Administration

An aid in the decreased capacity of the patient in states of pancreatic deficiency.

Bottles of 100, 500 and 1000 tablets.
Enterosol coated if desired.

G. W. CARNRICK CO.
20 Mt. Pleasant Avenue
Newark, New Jersey

Trypsogen

The growth of science is the evolution of a means of overcoming or avoiding limitations, uncertainty and the ambiguities of commonsense judgment.

Or, in the words of Whitehead: "The obvious commonsense notion has been entirely destroyed (by science) so far as concerns its function as the basis for all interpretation. One by one, every item has been dethroned."

Our quality pharmaceutical products are guaranteed as to purity and identity in assay of raw materials; accuracy, cleanliness and perfection of production, and uniformity and correct dosage of the finished products—all supported by laboratory control records for the protection of the medical profession and their patients.

WILLIAM P. POYTHRESS & COMPANY
INCORPORATED
RICHMOND, VIRGINIA

Body CALCIUM
Blood ALKALI
Quickly Restored
with
C-G ALKALIZER
Effervescent

CONTENTS 8 OUNCES
EMERSON'S
C-G
ALKALIZER
EFFERVESCENT
·ZESTFUL·EFFERVESCENT·
·REFRESHING·
URIC ALKALINITY LASTING FOUR TO SIX HOURS MAY BE INDUCED BY ONE DOSE REPEATED IN HALF HOUR
SIX TEASPOONFULS WILL FURNISH AS MUCH CALCIUM AS IS IN THE AVERAGE DAILY DIET
EMERSON DRUG CO.
BALTIMORE, MD., U.S.A.

Each heaping teaspoonful of Emerson's C-G Alkalizer contains a substantial quantity of calcium gluconate, regarded as the most easily-assimilable form of calcium available today.

Unlike the harsh, earthy alkali compounds, C-G Alkalizer furnishes alkali salts to the blood with no damage to normal HCl of the stomach. A goodly quantity of pure sodium citrate in every dose provides *systemic* alkalinity *physiologically*. No danger of alkalosis. Digestion is aided, *not* harmed.

For a rich source of calcium and alkali for blood and tissues, turn to C-G Alkalizer—in pregnancy deficiencies and nausea, convalescence, diarrhea, common cold; la grippe and other febrile diseases; wherever acidosis strikes.

LOW COST—PALATABLE

C-G Alkalizer costs 25% to 35% less than other good alkalizers. Its snow-white granules make a zestful, effervescent drink.

EMERSON DRUG COMPANY
BALTIMORE • MARYLAND

Use Coupon for Free Full-Size Package

EMERSON DRUG CO.
Baltimore *Maryland*

Please send me FREE a full-size market package of Emerson's C-G Alkalizer.

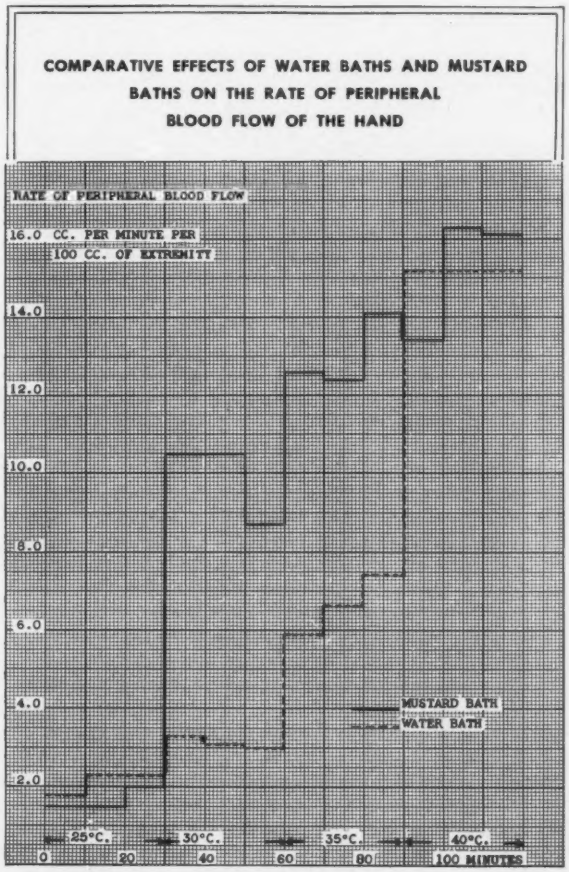
NAME_____

ADDRESS_____

CITY_____ STATE_____

SM-7

Mild Mustard Baths at 35° to 40° C. Achieve Optimum Result . . .



COLMAN'S MUSTARD

THE mustard bath containing 0.5% to 0.6% mustard solution, at 35° to 40° C., increases the rate of peripheral blood flow as much as 74% above the level attained by plain water bath of the same temperature.

The optimum effect is obtained in from 10 to 20 minutes. As large a body surface as possible should be exposed to the mustard bath.

To 10 gallons of water (about half the capacity of the average tub), use half a pound of mustard.

Indicated as an aid in correcting disturbances of peripheral circulation. As adjunctive treatment: in reducing fevers, in cases of upper respiratory tract infections, in treating exposure to cold or infection. Insomnia, nervous and muscular fatigue.

A copy of recently published results of experimental studies of effects of mustard baths on the peripheral vascular system will be sent to physicians upon request.

ATLANTIS SALES CORP.
ROCHESTER, NEW YORK

Are the Neuritic Symptoms of Pregnancy *due to a deficiency of vitamins B_1 and G?*

SUCH common neuritic symptoms of pregnancy as pains in arms and legs, muscle weakness, and (less frequent but more serious) paralysis of the extremities may result from a shortage of antineuritic vitamins, recent investigations appear to show. Although neuronitis of pregnancy has long been considered a toxemia, no toxins have ever been identified.

Clinical observations of Strauss and McDonald lead to the conclusion that the condition is a dietary deficiency disorder similar to beriberi, caused by lack of vitamin B_1, complicated by symptoms which may be traced to shortage of vitamin G. They report recovery in their cases receiving this therapy, including dried brewers' yeast.

Hyperemesis as Cause of Avitaminosis

Wechsler observes that all cases of polyneuritis of pregnancy recorded in the literature were preceded by long periods of severe vomiting. "It would seem," he adds, "that because of actual starvation these patients suffered from avitaminosis and consequent neuritis," a view likewise held by Hirst, Luikart, and Gustafson. Plass and Mengert observe that the practice of giving high carbohydrate feedings for hyperemesis gravidarum is still more likely to cause avitaminoses B and G.

Dried brewers' yeast, as it is far richer than any other food in vitamins B_1 and G, is being used with benefit both in the prevention and treatment of polyneuritic symptoms of pregnancy. Lewy found that additions of yeast to the diet reduced electric irritability of the peripheral nerves and brought clinical improvement. Vorhaus states that he and his associates, after administering large amounts of vitamin B_1 to 250 patients having various types of neuritis, including that of pregnancy, observed in about 90% of cases "varying degrees of improvement, i.e., from partial relief of pain to complete disappearance of all symptoms."

Need for Vitamins B and G in Lactation

Evans and Burr, Hartwell, Sure and co-workers, and Macy *et al* are among numerous authorities who find that the nursing mother also needs supplements of vitamins B_1 and G, from 3 to 5 times the normal requirement. Tarr and McNeile report that the physical, mental, and emotional status of 120 pregnant and lactating women receiving Mead's Brewers Yeast and other foods high in vitamin B was superior to that of a control group of 116 women.

Since the management of polyneuritis of pregnancy is difficult at best, it would appear logical to supply those dietary substances which may safeguard against it. One of the richest and most convenient sources of the anti-neuritic factors, vitamins B_1 and G, is Mead's Brewers Yeast Tablets. Consisting of nonviable yeast, they offer not less than 25 International vitamin B_1 units and 42 Sherman vitamin G units per gram.

Supplied in bottles of 250 and 1,000 tablets, also in 6-oz. bottles of powder.

Please enclose professional card when requesting samples of Mead Johnson products to cooperate in preventing their reaching unauthorized persons.

Mead Johnson & Company, Evansville, Indiana, U. S. A.

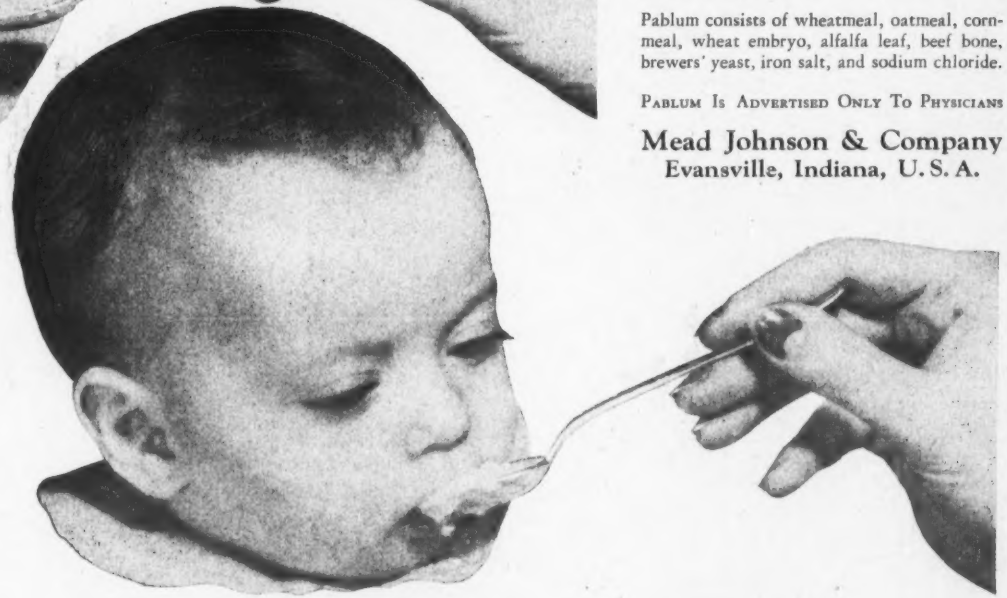
His First Solid Food

PABLUM is now being fed to infants as early as the third or fourth month because it gets the baby accustomed to taking food from a spoon, but, most important, Pablum early adds essential accessory food substances to the diet. Among these are vitamins B_1 and G and calcium and, perhaps most necessary, iron. Soon after a child is born its early store of iron rapidly diminishes and, as milk is poor in iron, the loss is not replenished by the usual bottle-formula. Pablum, therefore, fills a long-felt need, for it is so well tolerated that it can be fed even to the three-weeks'-old infant with pyloric stenosis, and yet is richer than fruits, eggs, meats, and vegetables in iron. Even more significant, Pablum has succeeded in raising the hemoglobin of infants in certain cases where an iron-rich vegetable failed. Pablum is an ideal "first solid food." ***Mothers appreciate the convenience of Pablum as it needs no cooking. Even a tablespoonful can be prepared simply by adding milk or water of any temperature.***

Pablum consists of wheatmeal, oatmeal, cornmeal, wheat embryo, alfalfa leaf, beef bone, brewers' yeast, iron salt, and sodium chloride.

PABLUM IS ADVERTISED ONLY TO PHYSICIANS

Mead Johnson & Company
Evansville, Indiana, U. S. A.



The baby's first solid food always excites the parents' interest. Will he cry? Will he spit it up? Will he try to swallow the spoon? Far more important than the child's "cute" reactions is the fact that figuratively and physiologically this little fellow is just beginning to eat like a man.

PARKE-DAVIS THEELIN AND KAPSEALS THEELOL

Theelin, introduced to the medical profession in January, 1931, by Parke, Davis & Company, marked a new phase in endocrine therapy. This active estrogenic substance was isolated and identified both chemically and pharmacologically by Dr. E. A. Doisy of St. Louis University. Subsequently Dr. Doisy isolated Theelol, a related product. The further development of these two preparations for clinical application was carried out through cooperative work on the part of the staffs of the Research Laboratory and the Department of Experimental Medicine of Parke, Davis & Company.

Theelin (ketohydroxyestratriene) for intramuscular administration, and Theelol (trihydroxyestratriene) for oral use, are chemically pure estrogenic substances rigidly standardized by physiological and chemical methods. To facilitate proper dosage, the following package forms are available:

FOR INTRAMUSCULAR ADMINISTRATION

THEELIN (AQUEOUS) AMPOULES
0.02 mg.—200 international units
(Ampoule No. 167)

THEELIN IN OIL AMPOULES
0.1 mg.—1000 international units
(Ampoule No. 178)

THEELIN IN OIL AMPOULES
0.2 mg.—2000 international units
(Ampoule No. 179)

THEELIN IN OIL AMPOULES
1.0 mg.—10,000 international units
(Ampoule No. 182)

Supplied in boxes of six and fifty 1-cc. ampoules.

FOR VAGINAL ADMINISTRATION

THEELIN VAGINAL SUPPOSITORIES
0.2 mg.—2000 international units

Supplied in boxes of six suppositories.

FOR ORAL ADMINISTRATION

KAPSEALS THEELOL
0.06 mg. (No. 353)

KAPSEALS THEELOL
0.12 mg. (No. 358)

Supplied in bottles of 20, 100 and 250.

Descriptive literature, discussing these products in detail, is available on request.

The World's Largest Makers of Pharmaceutical and Biological Products

PARKE, DAVIS & COMPANY

DETROIT MICHIGAN